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INTRODUCTION

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02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics. **2530**

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Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics. **2564**

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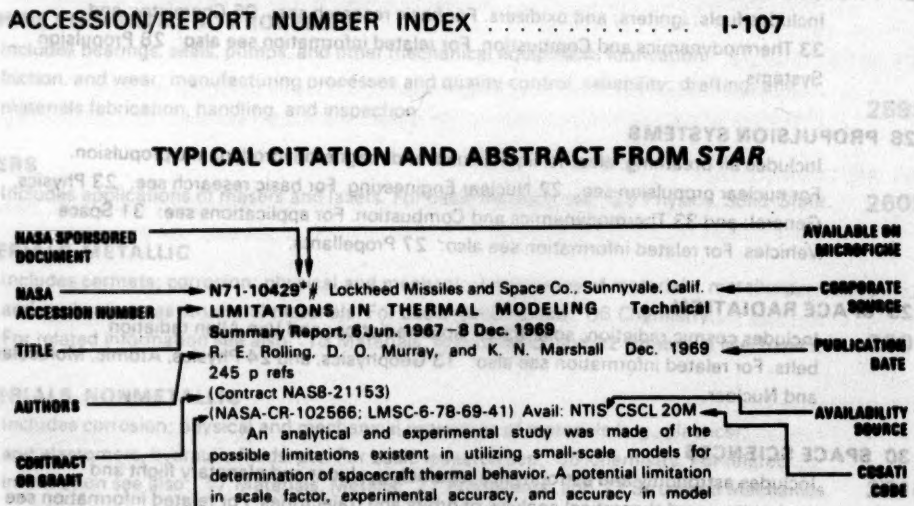
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An analytical and experimental study was made of the possible limitations existent in utilizing small-scale models for determination of spacecraft thermal behavior. A potential limitation in scale factor, experimental accuracy, and accuracy in model design is associated with each spacecraft design. Individual problem areas of thermal modeling are treated separately. Author
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Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N71-28007*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

FLOW PATTERNS AND PRESSURE DISTRIBUTIONS AROUND A BLUFF AFTERBODY IN THE WAKE OF A 120 DEG CONE FOR VARIOUS SEPARATION DISTANCES AT MACH 3.0

William D. Deveikis and James Wayne Sawyer Washington Jun. 1971 43 p refs

(NASA-TN-D-6281; L-7542) Avail: NTIS CSCL 20D

A wind-tunnel investigation of an attached inflatable decelerator concept was conducted at a Mach number of 3.0 with solid models to observe the effects of varying the separation distance between the 120 deg cone forebody and the inflated afterbody shape on flow patterns and pressure distributions. Flow-visualization tests were conducted for separation distances up to 4.74 forebody diameters and at free-stream Reynolds numbers, based on afterbody maximum diameter, between 570,000 and 3,200,000. Pressure-distribution tests were conducted for separation distances up to 2.49 forebody diameters at free-stream Reynolds numbers, based on afterbody maximum diameter, between 10,000,000 and 11,800,000. The afterbody was constructed with a burble fence so that the afterbody-to-forebody frontal area ratio was 6.2.

Author

N71-28008*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

EXPERIMENTAL INVESTIGATION OF THE USE OF SLOTTED TEST SECTION WALLS TO REDUCE WALL INTERFERENCE FOR HIGH LIFT MODEL TESTING

Kalman J. Grunwald Washington Jun. 1971 73 p refs

(NASA-TN-D-6292; L-6884) Avail: NTIS CSCL 20D

An investigation of various test-section configurations with slotted sidewalls, both slotted and open lower boundaries, and slotted and closed upper boundaries was carried out in a small wind tunnel. Additional variables investigated include slot width and slot length. A full-span, jet-flap model with an aspect ratio of 4.0 was tested in a large test section to obtain essentially free-air conditions and in a small test section with closed walls as well as slotted walls to obtain a measure of the effectiveness of the slotted-wall configurations in reducing the wall effects. The model was also fitted with a horizontal tail to obtain a measure of the wall effects and the effectiveness of the slotted walls in reducing these wall effects at the tail. The results of the investigation indicated that the use of test-section configurations with three and four slotted walls resulted in large reductions in the wall-interference effects.

Author

N71-28009*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

EFFECTS OF SPANWISE VARIATION OF GUST VELOCITY ON ALLEVIATION SYSTEM DESIGNED FOR UNIFORM GUST VELOCITY ACROSS SPAN

L. Keith Barker Washington Jun. 1971 23 p refs

(NASA-TN-D-6346; L-7693) Avail: NTIS CSCL 20D

An analytical study was made of the effectiveness of a gust-alleviation system in turbulent air. The system consisted of a vane mounted ahead of the wing to sense vertical gust velocity and of flaps driven in response to the vane deflection to reduce the accelerations induced by the gusts. The primary purpose of the study was to examine the effectiveness in two-dimensional turbulence (spanwise variation of gust velocity) of a system which was designed on the basis of one-dimensional turbulence (no spanwise variation of gust velocity). The results of the study indicated that the performance, as measured by the percent reduction in the mean-square lift on the wing, is about the same whether the turbulence is one- or two-dimensional, when the system is designed on the basis of optimum alleviation in one-dimensional turbulence.

Author

N71-28411# Naval Postgraduate School, Monterey, Calif.

THE APPLICATION OF HOLOGRAPHIC INTERFEROMETRY TO THE DETERMINATION OF THE FLOW FIELD AROUND A RIGHT CIRCULAR CONE AT ANGLE OF ATTACK

Ravi Chandar Jagota (M.S. Thesis) Dec. 1970 151 p refs

(AD-721543) Avail: NTIS CSCL 20/4

The report extends the use of holography to the study of density fields around opaque bodies as would normally be encountered in wind tunnel experiments. The density field around a 10 degree half-angle cone at zero and ten degree angle of attack was investigated in a supersonic wind tunnel. In these experiments, the finite fringe method for the production of interferograms was, for the first time, applied to holographic interferometry. The density field obtained from the reduction of the interferograms was found to agree with that obtained from an analytical solution of the governing equations. The computer program used for the reduction of the interferograms was evaluated for the effect of the presence of the cone and the shock wave and was found to yield stable and accurate results.

Author (GRA)

N71-28580# Aerospace Research Labs., Wright-Patterson AFB, Ohio. Hypersonic Research Lab.

CONFIGURATION OPTIMIZATION OF A CLASS OF HYPERSONIC CRUISE VEHICLES

Richard C. Walker (Ph.D. Thesis – Air Force Inst. of Tech.) Dec. 1970 141 p refs
(AD-721471; ARL-70-0342) Avail: NTIS CSCL 20/4

An optimization of air breathing hypersonic cruise vehicles was performed in order to determine basic configuration characteristics and performance trends. A distinctive feature of the investigation is that prediction techniques such as the method of characteristics were used to determine the flow field surrounding the vehicle; therefore, any interaction between the aerodynamic and propulsive flow fields is accounted for in a fundamental manner. The general class of vehicles considered in the study cruise in the Mach 8-12 speed regime, utilize a hydrogen fueled supersonic combustion ramjet engine, and can be geometrically characterized as two-dimensional wedgelike shapes. Configurations were optimized for maximum cruise range as determined from the Breguet range equation which incorporates a measure of the aerodynamic, propulsive, and volumetric efficiencies of a configuration. A generalized configuration model was defined by a discrete parameters which transformed the variational problem to a static or discrete optimization problem. The direct method of function optimization, utilizing search algorithms such as random point and adaptive creeper techniques, was employed to determine the value of the parameters defining the optimum configuration for cruise at design Mach numbers of 8, 10, and 12. The design parameter space in the vicinity of the optimum point was explored to show performance sensitivity. Author (GRA)

N71-28607*# National Aeronautics and Space Administration, Washington, D.C.
FORMATION AND PROPAGATION OF A SHOCK WAVE FROM A CONCAVE BOUNDARY
Dudley G. Mc Connell Jul. 1971 17 p refs
(NASA-TN-D-6319; E-6241) Avail: NTIS CSCL 20D

A shock wave formation in a two-dimensional flow field and a method of predicting the shape and strength of the shock wave are discussed. The present method consists of first finding the envelope of characteristics forming in the field from the bounding streamline. In a simple wave field, the envelope can be given in closed form; in a complex wave field, the envelope results from a solution of the whole field. Once the envelope is found, criteria and methods are presented for locating the shock within the envelope. In simple waves, the shock path results from a point by point integration; in complex waves, the principle of minimum entropy production may be used to pick out the most likely shock location. Specific examples of the simple wave case are presented. Author

N71-28778*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COMPARISONS OF TURBULENT-BOUNDARY-LAYER MEASUREMENTS AT MACH NUMBER 19.5 WITH THEORY AND AN ASSESSMENT OF PROBE ERRORS
Ivan E. Beckwith, William D. Harvey, and Frank L. Clark Washington Jun. 1971 92 p refs
(NASA-TN-D-6192; L-7020) Avail: NTIS CSCL 20D

Measurements of total temperature and pitot pressure have been made across the boundary on the test-section wall of an axisymmetric contoured nozzle at Mach 19.5 in nitrogen. The ratio of wall temperature to stagnation temperature was about 0.17. The Reynolds number based on momentum thickness varied from about 3500 to 4800 and the boundary-layer thickness varied from 8.6 to 11.2 centimeters (3.4 to 4.4 in.). A general review and assessment of probe errors is included. Mach number, velocity, and temperature profiles through the boundary layer are compared with previous data and with predictions from finite-difference procedures for calculating compressible turbulent and laminar boundary layers. These comparisons indicated that the boundary layer on the test-section wall was turbulent or transitional, whereas in the throat region of the nozzle the boundary layer may have been laminar for the present test conditions. The analysis includes estimates of skin friction, heat transfer, velocity fluctuations through the boundary layer, and the exponent in the power-law velocity profile. Author

N71-28872*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
IN-FLIGHT USE OF TRAVERSING BOUNDARY-LAYER PROBES
Edwin J. Saltzman Washington Jul. 1971 32 p refs
(NASA-TN-D-6428; H-640) Avail: NTIS CSCL 14B

Two prototype traversing boundary layer pitot probes were demonstrated in flight. A motor operated, screw driven type of probe was used on two jet aircraft for defining boundary layers at profile edge Mach numbers from 0.5 to 2.2. The other type of traversing probe was motor driven through a Scotch yoke mechanism and was operated on several flights of the X-15 airplane. The highest free stream Mach number reached during this series of flights was 5.6. The mechanical and electrical features of these probes are described, and photographs and conceptual drawings are included. Problems encountered during the development of the devices are described, and the solutions that were found are explained. Boundary layer profile data are presented in several forms, and local friction coefficients derived from the profile through a Clauser type of determination are shown. Author

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N71-28010# Royal Aircraft Establishment, Farnborough (England).
CONDITIONS FOR THE CONSTRUCTION OF GLIDERS WITH A LIFT-DRAG RATIO OF 100 [KONSTRUKTIONSBEDINGUNGEN FUER SEGELFLUGZEUGE MIT EINER GLEITZAHL VON 100]
L. Siencnik Feb. 1971 39 p refs Transl. into ENGLISH from German report
(RAE-LIB-Trans-1565) Avail: NTIS

Optimum lift coefficient and the most favorable aspect ratio are determined analytically. Results suggest that gliders, of lift-drag ratio approaching 100, may be considered. A treatment is given of the probable nature of the laminar-turbulent boundary at various pressure gradients and vanishing level of turbulence of the flow. The theory of the stability of the boundary layer on the wall and in a free stream serve as a basis for this treatment, as well as measurements on various bodies. A velocity distribution is developed suitable for profile design with a constant boundary-layer form parameter. Together with the earlier results, new conclusions are reached. Most conspicuous is the high lift coefficient which can be achieved with a laminar boundary layer at low Reynolds number. Airframe weight is then determined, under simplified conditions, as a constant times span times aspect ratio plus a second constant; this is more true, the greater the aspect ratio of the wing. A similarity relationship for the torsional stiffness, describes stiffness as inversely proportional to the wing area; assuming that the wing skin thickness is determined by the bending strength. Author

N71-28021*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FLIGHT TESTS OF CROSS, MODIFIED RINGSAIL, AND DISK-GAP-BAND PARACHUTES FROM A DEPLOYMENT ALTITUDE OF 3.05 km (10000 FT)
Clinton V. Eckstrom and Harold N. Murrow Washington Jun.

1971 58 p refs
(NASA-TM-X-2221; L-7389) Avail: NTIS CSCL 01C

Eleven parachute flight tests were conducted to obtain low-altitude deployment and performance data on cross, modified ringsail, and disk-gap-band parachutes that had previously been flight tested at earth altitudes above 30.5 km (100,000 ft). Parachute details, flight test conditions, opening loads, and performance data are presented for each of the flight tests. For seven of the flight tests, structural load data are presented as obtained from miniature load cells installed at various points in the suspension lines and canopy of each of the three parachute configurations. Author

N71-28077*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PRESSURE DISTRIBUTIONS ON A WING HAVING NACA 4415 AIRFOIL SECTIONS WITH TRAILING-EDGE FLAPS SET AT 0 DEG AND 40 DEG
Arthur W. Carter Washington Jun. 1971 74 p refs
(NASA-TM-X-2225; L-7568) Avail: NTIS CSCL 01A

An investigation was made in the Langley 300-MPH 7- by 10-foot tunnel through a range of free-stream dynamic pressures and through a range of angles of attack to determine the chordwise pressure distributions on a wing having NACA 4415 airfoil sections with flaps set at 0 deg and deflected down 40 deg. The unswept, untapered wing had an aspect ratio of 6 and full-span 30-percent-chord slotted flaps. The results of the investigation are presented as curves of chordwise pressure distributions at the 25-percent-semispan wing station. Tabulated pressure data are also presented as well as the longitudinal aerodynamic characteristics of the model corresponding to the pressure data. Author

N71-28189# National Transportion Safety Board, Washington, D.C.
AIRCRAFT ACCIDENT REPORTS, BRIEF FORMAT: US CIVIL AVIATION, ISSUE NUMBER 1: 1970 ACCIDENTS
[1971] 515 p
(NTSB-BA-71-1) Avail: NTIS HC $6.00/MF $0.95

Selected aircraft accident reports are presented, in brief format, for accidents occurring in U.S. civil aviation operations during the calender year 1970. A random selection of 894 general aviation and 16 air carrier accidents are included. The brief format presents the facts, conditions, circumstances, and probable cause(s) for each accident. Additional statistical information is tabulated by type of accident, phase of operation, kind of flying, injury index, aircraft damage, conditions of light, pilot certificate, injuries, and causal factors. Author

N71-28216# Waldo and Edwards, Inc., Redondo Beach, Calif.
THE US COMMUTER AIRLINE INDUSTRY: ITS CURRENT STATUS AND FUTURE OUTLOOK
Nov. 1970 50 p refs
(Contract DOT-W1-71-0871-1)
(AD-718871; Rept-70-109) Avail: NTIS CSCL 5/3

The report is meant to provide an analysis of the current status and future outlook for the air taxi industry from the operational, financial and market standpoint. Financial aspects are emphasized. The purpose is to provide information which will permit FAA to assess the impact of the industry on the aviation facilities system and to determine the extent to which air taxi operations should be taken into account in aviation facilities planning criteria. Author (GRA)

N71-28217# Stanford Research Inst., Menlo Park, Calif.
VISIBILITY MEASUREMENT FOR AIRCRAFT LANDING OPERATIONS Final Report, 28 Sep. 1969 - 30 Sep. 1970
Ronald T. H. Collis, William Viezee, Edward E. Uthe, and John Oblanas 30 Sep. 1970 149 p refs
(Contracts F19628-70-C-0083; DOT-FA70WAI-178)
(AD-716483; AFCRL-70-0598) Avail: NTIS CSCL 4/1

An experimental pulsed neodymium lidar system was modified and calibrated to obtain accurate data on atmospheric extinction properties in fog and low cloud conditions. The objective was to establish the theoretical and practical basis of a system for measuring slant visibility conditions for aircraft landing operations. To operate in conditions of fog and low cloud the lidar systems dynamic range was extended to 50 DB by using a two-stage receiver system. In addition, the transmitter and receiver beams were made coaxial to make close-range observations. Author (GRA)

N71-28222*# Techtran Corp., Glen Burnie, Md.
NOISE REDUCTION IN A TURBULENT JET BY THE METHOD OF REPEATED AIR INJECTION [SNIZHENIE SHUMA TURBULENTNOI STRUI METODOM VDUVA VTORICHNOGO VOZDUKHA]
B. N. Melnikov et al Washington May 1971 7 p refs Transl. into ENGLISH from Samoletostr. Tekh. Vozdush. Flota (USSR), no. 18, 1970 p 28 - 30
(Contract NASw-2037)
(NASA-TT-F-13667) Avail: NTIS CSCL 01B

Experiments prove that if air is injected normal to the jet axis at the boundary of the jet, optimal exit velocity profiles can be obtained which lower acoustic power emission. Expressions are derived for the flow parameters in a turbulent axisymetrical gas jet. Application of this technique results in a noise level reduction of approximately 21 dB. Author

N71-28274# Army Electronics Command, Fort Monmouth, N.J.
ANALYTIC COMPARISON OF HELICOPTER HOVER CONTROL SYSTEMS
R. John Niemela, Jr. (M.S. Thesis - Penn. Univ.) Dec. 1970 63 p refs
(AD-721728; ECOM-3367) Avail: NTIS CSCL 1/3

The effectiveness of an attitude feedback and a translational velocity feedback flight control system are assessed for their ability to provide positional stability and reduce the pilots task at hover. The significance of helicopter hover dynamics is discussed with respect to positional stability. The helicopter pilot is viewed as a control element to provide positional stability at hover in the presence of wind gusts. The velocity feedback control is compared with the attitude feedback and found to have a significantly lower mean squared positional error and to require less pilot effort. The frequency of exceeding a specific value of positional error and its relation to the power spectral density of positional error is discussed. Author (GRA)

N71-28276# Boeing Co., Seattle, Wash. Vertol Div.
AN INVESTIGATION OF NOISE GENERATION ON A HOVERING ROTOR
H. Sternfold, R. H. Spencer, and J. O. Schairer Jan. 1971 387 p refs
(Contract DAHC04-69-C-0087)
(AD-721312; AROD-8704-2-E) Avail: NTIS HC $8.00/MF $0.95 CSCL 20/1

This report presents the results of a program of helicopter rotor noise measurement. The program was carried out using a 60-foot diameter CH-47B 3-bladed rotor on the Boeing-Vertol engineering rotor whirl tower. The primary objectives were: to obtain acoustical data over a frequency range wide enough to define all elements of rotor noise under well-documented ambient conditions, to measure the tip vortex position with respect to a trailing blade using high-speed cameras and smoke to visualize the tip vortex and to relate blade-vortex separation distance to noise level, to determine the propagation characteristics of rotor noise, and to evaluate two current analytical procedures for predicting rotor noise against the measured data. Tipspeeds ranged from 600 to 900 fps and thrusts ranged from 6300 to 32,000 pounds (disk load 2.2 to 11.3 pounds per square foot). Author (GRA)

N71-28338# Dynasciences Corp., Blue Bell, Pa.
STABILITY AND CONTROL HANDBOOK FOR COMPOUND

HELICOPTERS
E. K. Geray and E. Kisielowski Feb. 1971 675 p refs
(Contract DAAJ02-69-C-0023)
(AD-722250; DCR-314; USAAVLABS-TR-70-67) Avail: NTIS CSCL 1/3

The handbook contains analytical methods and stability data for determining the dynamic stability and control characteristics of generalized single-rotor compound helicopter configurations. The methods use calculation procedures which are considerably simplified through the extensive use of information presented in graphs and charts. These charts are applicable to articulated, teetering, and hingeless rotor systems and cover a range of flight conditions from hover to high forward speeds. The charts for low forward speeds were obtained from the rotor performance data based on classical rotor theory. However, the high-speed charts exclude the major assumptions of classical theory and include blade compressibility, stall, reverse flow, large inflow ratios, etc. The information presented is suitable for extensive digital and analog computer studies as well as for rapid manual computations such as required for preliminary design applications. Author (GRA)

N71-28363*# National Aeronautics and Space Administration, Washington, D.C.
THIRD CONFERENCE ON SONIC BOOM RESEARCH
Ira R. Schwartz, ed. 1971 431 p refs Conf. held at Washington, D.C., 29 - 30 Oct. 1970
(NASA-SP-255) Avail: SOD $2.00; NTIS HC $6.00/MF $0.95 CSCL 20A

The current status of sonic boom research is reviewed and critical areas of supersonic and hypersonic transport operations are pointed out. Prediction methods for sonic boom generation and propagation consider the effects of supersonic transport shape, atmospheric turbulence, and overland operation at low supersonic speeds to minimize overpressure impact. For individual titles see: N71-28364 through N71-28394.

N71-28364*# Aeronautical Research Inst. of Sweden, Stockholm.
NONLINEAR EFFECTS ON SONIC BOOM INTENSITY
M. Landahl, I. Ryhming, and P. Lofgren *In* NASA, Washington 3d Conf. on Sonic Boom Res. 1971 p 3 15 refs (See N71-28363 16-02)
Avail: SOD $2.00; NTIS HC $6.00/MF $0.95 CSCL 20A

Application of a coordinate perturbation to the second order solution for axisymmetric flow makes it possible to analyze nonlinear effects on sonic boom and to assess the accuracy of the first order theory. This extension of Whitham's principle to second order is used to approximate the flow field within a distance of one body length of a slender configuration. It also applies at large distances for nonaxisymmetric flow expressed in cylindrical coordinates when a third, angular, variable is used as well. The second order solution is used to determine the effect of a small perturbation on a nonaxisymmetric flow. A simple approximation is used to show small errors in the calculation scheme to build up a nonlinear flow field through step-by-step small perturbations. G.G.

N71-28365*# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
NUMERICAL SOLUTIONS FOR THE COMPLETE SHOCK WAVE STRUCTURE BEHIND SUPERSONIC EDGE DELTA WINGS
Harvard Lomax and Paul Kutler *In its* 3d Conf. on Sonic Boom Res. 1971 p 17 - 25 refs (See N71-28363 16-02)
Avail: SOD $2.00; NTIS HC $6.00/MF $0.95 CSCL 20A

Numerical finite difference methods carried out on a digital computer coupled to a cathode ray tube were used to simulate flow fields for a variety of wings, bodies, and their combinations. A distance asymptotic procedure was employed to solve the three dimensional hyperbolic, steady flow equations for the conical shapes and nonconical flow field calculations were performed for the three dimensional flow behind a lifting delta wing. This shock capturing technique for computing the coalescing shock field surrounding wing-body combinations was effective if calculations were monitored by real-time reaction to visual displays. G.G.

N71-28366*# Princeton Univ., N.J.
THEORETICAL PROBLEMS RELATED TO SONIC BOOM
W. D. Hayes, J. H. Gardner, D. A. Caughey, and F. B. Weiskopf, Jr. *In* NASA, Washington 3d Conf. on Sonic Boom Res. 1971 p 27 31 refs (See N71-28363 16-02)
Avail: SOD $2.00; NTIS HC $6.00/MF $0.95 CSCL 20A

The passage of a sonic boom through a caustic is analyzed by using a simple variant of the transonic flow equation. A Lax Wendroff algorithm is applied to describe the flow field and the pressure levels near a symmetric airfoil in transonic flow, with the flow subsonic at infinite. There is a single shock; the outer point of the shock disappears into the elliptic region and the foot of it on the airfoil is regarded as a nonanalytical point in the flow field. G.G.

N71-28367*# Cornell Univ., Ithaca, N.Y.
THE EFFECTS OF ATMOSPHERIC INHOMOGENEITIES ON SONIC BOOM
A. R. George *In* NASA, Washington 3d Conf. on Sonic Boom Res. 1971 p 33 57 refs (See N71-28363 16-02)
Avail: SOD $2.00; NTIS HC $6.00/MF $0.95 CSCL 20A

The effects of atmospheric turbulence on sonic boom signatures were simulated by calculating the relationship between shock thickness and its turbulent field. It is shown that there is an effective dissipation of energy due to scattering. G.G.

N71-28368*# Cornell Univ., Ithaca, N.Y.
PERTURBATIONS BEHIND THICKENED SHOCK WAVES
Kenneth J. Plotkin *In* NASA, Washington 3d Conf. on Sonic Boom Res. 1971 p 59 66 refs (See N71-28363 16-02)
Avail: SOD $2.00; NTIS HC $6.00/MF $0.95 CSCL 20A

Turbulence effects on sonic boom signatures cause the appearances of random spikes and wiggles behind the shock waves. Calculations based on the decay of first scattered waves through further scattering show that the perturbations have a finite maximum near the shock front and this this maximum is of the same order as the shock overpressure. Approximations found that the maximum perturbations immediately behind the shock vary only moderately with turbulent intensity. G.G.

N71-28369*# Columbia Univ., New York.
ANALYSIS OF THE MULTIPLE SCATTERING OF SHOCK WAVES BY A TURBULENT ATMOSPHERE
W. J. Cole and M. B. Friedman *In* NASA, Washington 3d Conf. on Sonic Boom Res. 1971 p 67 74 refs Prepared in cooperation with Bell Telephone Labs., Inc., New York (See N71-28363 16-02)
Avail: SOD $2.00; NTIS HC $6.00/MF $0.95 CSCL 20A

A nonperturbative multiple scattering theory is used to predict shock thickening and fluctuation intensity of sonic boom pressure signatures superimposed on the basic N-shape pattern. Coupling between the intensity of the fluctuations and the continuously thickening shock profile is considered in the scatter propagation of an acoustic wave in a random medium. G.G.

N71-28370*# Columbia Univ., New York.
UNIFORM WAVEFRONT EXPANSIONS FOR DIFFRACTED AND FOCUSING WAVES
M. K. Myers *In* NASA, Washington 3d Conf. on Sonic Boom Res. 1971 p 75 86 refs (See N71-28363 16-02)
Avail: SOD $2.00; NTIS HC $6.00/MF $0.95 CSCL 20A

Asymptotic approximations to the linear solutions valid near a wave front are developed that are free of anomalous singularities

and can be used to predict diffracted as well as focusing wave propagation in sonic boom technology. Appropriate straining of coordinates yields a first approximation to the exact solution of the problem. Detailed structures of the linear potential fields for both wave propagations are obtained by using a set of equations of motion in which the nonlinear effects are known to be nonsingular throughout the field. G.G.

N71-28371*# Cornell Univ., Ithaca, N.Y.
NONLINEAR ACOUSTIC BEHAVIOR AT A CAUSTIC
R. Seebass *In* NASA, Washington 3d Conf. on Sonic Boom Res. 1971 p 87–120 refs (See N71-28363 16-02)
Avail: SOD $2.00; NTIS HC $6.00/MF $0.95 CSCL 20A

A formal analytical solution of the transonic flow equation is reported that describes the nonlinear acoustic behavior at a caustic in terms of a linear equation for a special incoming signal with finite rise time. Except for the maximum amplitude of the reflected signal, the simple linear solution gives an adequate description of pressure signatures in sonic booms predictions. G.G.

N71-28372*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
UNIFORM APPROXIMATIONS FOR SHOCKS GENERATED BY THIN NONLIFTING RECTANGULAR WINGS
M. B. Friedman (Columbia Univ.) and S. Davis *In its* 3d Conf. on Sonic Boom Res. 1971 p 123–132 refs (See N71-28363 16-02)
Avail: SOD $2.00; NTIS HC $6.00/MF $0.95 CSCL 20A

A uniform approximation in the ray form is derived to develop flow fields and shocks produced by the leading edge of an almost planar wing of rectangular planform and symmetrical airfoil section at zero angle of attack. The presence of sharp corners in the planform and the finite span produce diffraction-like effects from the wingtips and a symmetrical disturbance field with regions of rapid variations more than one direction at various locations. Comparison of far field shock strength predictions based on the uniform approximation and those based upon the equivalent body approximation show good agreement for regions directly below and to the side of the wing. In the near field region directly below the wing where the plane shock dominates, the two predictions differ for the larger aspect ratio. The magnitude of the difference between the two predictions depends upon the scale distance at which the near field effects tend to disappear because of tip and cone interactions. G.G.

N71-28373*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A PRELIMINARY INVESTIGATION OF SONIC BOOM WAVEFORMS NEAR FOCUSING RAY SYSTEMS
Sanford S. Davis *In its* 3d Conf. on Sonic Boom Res. 1971 p 133–146 (See N71-28363 16-02)
Avail: SOD $2.00; NTIS HC $6.00/MF $0.95 CSCL 20A

The characteristics of cusped shock waves are studied by using the analogy between steady supersonic flows and unsteady two dimensional flows. In this analogy, a thin wing is used to induce a cusped shock wave in the flow field. The characteristics of the shock wave in the vicinity of the cusp are investigated both analytically and experimentally. The solution is expressed directly as an integral over a distribution of elementary sources on the wing planform. The behavior of the singularities of this linear solution at and near the cusp is inferred directly by the confluence of the three neighboring roots corresponding to the intersection of the leading edge of the wing and the trace of the Mach forecone from the field point. This transparent form of the linearized solution, when expressed in a geometrical acoustics coordinate system, is used in conjunction with Whitham's hypothesis to obtain a uniformly valid first approximation to the exact nonlinear disturbance field. Author

N71-28374*# Massachusetts Inst. of Tech., Cambridge.
SOME ATTEMPTS TO THEORIZE ABOUT THE ANOMALOUS RISE TIMES OF SONIC BOOMS
Allan D. Pierce *In* NASA, Washington 3d Conf. on Sonic Boom Res. 1971 p 147–160 refs (See N71-28363 16-02)
Avail: SOD $2.00; NTIS HC $6.00/MF $0.95 CSCL 20A

Sonic boom distortion by atmospheric turbulence produces anomalous rise times of acoustic waveforms; larger rise times are developing when the distance from the ground track is increased. The physical mechanisms by which the turbulence creates spiked or rounded waveforms or anomalously large rise times are attributed to refraction, focusing, and wave front folding as integral parts of the distortion process. G.G.

N71-28375*# New York Univ., N.Y.
STUDIES IN THE DIFFRACTION OF A PULSE BY A THREE DIMENSIONAL CORNER
Lu Ting and Fanny Kung *In* NASA, Washington 3d Conf. on Sonic Boom Res. 1971 p 161–180 refs (See N71-28363 16-02)
(Grant NGL-33-016-119)
Avail: SOD $2.00; NTIS HC $6.00/MF $0.95 CSCL 20A

Sonic boom effects on three dimensional structural corners are approximated by progressing incident plane waves of an N-shape waveform. A solution for the diffraction of a plane pulse through decomposition of the N-wave is formulated and applied to the corner problem. The governing flow equations and the finite difference method used to solve the boundary conditions and to obtain a three dimensional conical solution, as well as the use of the conical solution for the computation of pressure distributions on surfaces due to a N-wave of any waveform and at any incident angle are discussed. G.G.

N71-28376*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PRELIMINARY NUMERICAL INVESTIGATION OF SONIC BOOM AT THRESHOLD MACH NUMBERS
Thomas J. Coakley *In its* 3d Conf. on Sonic Boom Res. 1971 p 181–191 refs (See N71-28363 16-02)
Avail: SOD $2.00; NTIS HC $6.00/MF $0.95 CSCL 20A

The threshold Mach number at which the sonic boom just reaches the ground is simulated by mathematically modeling a real flow problem where the incoming wave or disturbance is represented by a given flow deflection angle at the lower streamwise boundary of the channel. A uniform flow is assumed in the channel initially at which time the incoming disturbance angle is introduced impulsively. The resulting wave system propagates to the upper wall where it is reflected. The governing flow equations and the finite difference scheme used to solve the boundary conditions are discussed. The flow equations are Euler's inviscid equations expressed in conservation law form. The perfect gas law is assumed and the total energy is expressed as a function of pressure, density, and velocity. G.G.

N71-28377*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXPERIMENTAL STUDIES OF SONIC BOOM PHENOMENA AT HIGH SUPERSONIC MACH NUMBERS
Odell Morris *In its* 3d Conf. on Sonic Boom Res. 1971 p 193–203 refs (See N71-28363 16-02)
Avail: SOD $2.00; NTIS HC $6.00/MF $0.95 CSCL 20A

Results of recent sonic boom wind tunnel studies have been reviewed for several model configurations over a wide Mach number range. Comparisons of experimental and theoretical pressure signatures calculated by use of techniques derived from the work of Whitham and Hayes show good agreement for the complex airplane model configuration as well as for the simple body shapes in the lower Mach number and lower lift range. However, results of the high Mach number tests for the simple body and wing model

configurations show that the theoretical methods for predicting the pressure signatures appear to be only qualitatively correct at the high Mach numbers. In general, it is shown that the agreement between theory and experiment decreases with both increasing Mach number and increasing lift coefficient. Author

N71-28378*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

EXTRAPOLATION OF WIND TUNNEL SONIC BOOM SIGNATURES WITHOUT USE OF A WHITHAM F-FUNCTION

Charles L. Thomas *In its* 3d Conf. on Sonic Boom Res. 1971 p 205–217 refs (See N71-28363 16-02)

Avail: SOD $2.00; NTIS HC $6.00/MF $0.95 CSCL 20A

A method for extrapolating near field sonic boom pressure signatures through a variable atmosphere with winds has been presented. The effects of aircraft acceleration and flightpath angle are accounted for in the theory. Deformation of the waveform is described by the use of waveform parameters rather than through the use of a Whitham F-function. This approach provides for a simpler, more intuitive, and more compact theory for the propagation of weak pressure waves. Author

N71-28379*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

A NEAR AND FAR FIELD ANALYSIS OF THE SONIC BOOM EMITTED BY NONLIFTING RECTANGULAR WINGS

Sanford S. Davis *In its* 3d Conf. on Sonic Boom Res. 1971 p 219–226 refs (See N71-28363 16-02)

Avail: SOD $2.00; NTIS HC $6.00/MF $0.95 CSCL 20A

The results of an experimental investigation into the shock wave characteristics of a finite, rectangular wing have generally confirmed the predictions of the uniform theory. The existence of rapid variations in near field spanwise strengths and the subsequent smoothing effect of the tip core interactions have also been verified by the experiment. The equivalent body theory, while giving erroneous results in the near field, predicts the characteristics of the far field sonic boom below the wing quite well. In fact, the predictions of the uniformly vaid theory reduce to the equivalent body theory in the far field region below the wing. It is shown that near field effects cannot affect the far field signature below the wing in a radical manner and that the equivalent body theory can be expected to give a good approximation to the flow at these large distances. Author

N71-28380*# New York Univ., N.Y.

COUPLED ELASTIC AND ACOUSTIC RESPONSE OF ROOM INTERIORS TO SONIC BOOM

S. Slutsky and L. Arnold *In* NASA, Washington 3d Conf. on Sonic Boom Res. 1971 p 227–240 refs Sponsored by FAA (See N71-28363 16-02)

Avail: SOD $2.00; NTIS HC $6.00/MF $0.95 CSCL 20A

The time history of acoustic response within architectural structures due to sonic boom transients and aspects of signature that strongly influence undesirable internal acoustic response are studied. A convolution integral is used to relate the forcing signature response relationship in terms of the system transfer function. This transfer function is determined experimentally using scaled models as well as analytically. An inexpensive sonic boom generator was constructed, and input-output responses were recorded and converted to digital data. Transfer functions were computed and used to calculate responses to modified forcing signatures. Measured and calculated responses agree very well. It is concluded that this technique can be used to investigate a large variety of transient response problems as well as the coupled elastic-acoustic systems studied in the present program. Author

N71-28381*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

MEASUREMENTS OF SONIC BOOM SIGNATURES FROM FLIGHTS AT CUTOFF MACH NUMBER

Domenic J. Maglieri, David A. Hilton, Vera Huckel, Herbert R. Henderson, and Norman J. McLeod *In its* 3d Conf. on Sonic Boom Res. 1971 p 243–254 refs (See N71-28363 16-02)

Avail: SOD $2.00; NTIS HC $6.00/MF $0.95 CSCL 20A

Sonic boom measurements have been obtained from flight experiments of aircraft operating at cutoff Mach numbers to define the sonic boom pressure field at the shock wave extremity. The experimental results provide an indication of the depth and width of the focus region and a description of the pressure field near the shock extremity. U-shape or caustic signatures resulting in overpressure enhancement were observed at the shock wave extremities, and the highest measured levels are on the order of three times the nominal N-wave overpressures associated with operations at higher supersonic Mach numbers. The shock wave was found to be quite sensitive at its extremity to local atmospheric conditions. Good qualitative agreement with theory was obtained regarding the extent of the subsonic, sonic, and supersonic flow fields and their associated overpressure signature shapes. Author

N71-28382*# New York Univ., N.Y.

AIRPLANE CONFIGURATIONS FOR LOW SONIC BOOM

Antonio Ferri *In* NASA, Washington 3d Conf. on Sonic Boom Res. 1971 p 255–275 refs (See N71-28363 16-02)

(Grant NGL-33-016-119)

Avail: SOD $2.00; NTIS HC $6.00/MF $0.95 CSCL 20A

Supersonic transport (SST) configurations selected from the point of minimizing sonic booms are investigated. It is indicated that for a total length of 300 ft and total initial weight of the same order as the present U.S. SST designs, sonic booms having shock pressure rise of the order of 0.5 lb/sq ft can be obtained. Values as low as 0.3 lb/sq ft are possible for airplanes designed for cross country flights. Author

N71-28383*# New York Univ., N.Y.

OBSERVATIONS ON PROBLEMS RELATED TO EXPERIMENTAL DETERMINATION OF SONIC BOOM

Antonio Ferri and Huai-Chu Wang *In* NASA, Washington 3d Conf. on Sonic Boom Res. 1971 p 277–284 (See N71-28363 16-02)

(Grant NGL-33-016-119)

Avail: SOD $2.00; NTIS HC $6.00/MF $0.95 CSCL 20A

The use of experimental data permits obtaining sonic boom signatures at some distance from the body when the theory applies. However, wind tunnel irregularities and support interference influence the results unless these effects are taken into consideration. Three dimensional effects are important. Author

N71-28384*# Aeronautical Research Inst. of Sweden, Stockholm.

A NEW METHOD FOR DETERMINING SONIC BOOM STRENGTH FROM NEAR FIELD MEASUREMENTS

M. Landahl, I. Ryhming, H. Sorensen, and G. Drougge *In* NASA, Washington 3d Conf. on Sonic Boom Res. 1971 p 285–295 refs (See N71-28363 16-02)

Avail: SOD $2.00; NTIS HC $6.00/MF $0.95 CSCL 20A

A new method for determining the F-function based on accurate wind tunnel measurements of the flow inclination angles along a cylindrical surface that circumscribes the wind tunnel model has been presented. The new method seems to be quite feasible and has so far been used to predict the F-function to second order for a simple body of revolution. The complete mapping of a three dimensional flow field produced by an SST like configuration is being carried out in the wind tunnel. Author

N71-28385*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

A PRELIMINARY REPORT ON SHOCK COALESCENCE

Raymond M. Hicks and Charles L. Thomas *In its* 3d Conf. on Sonic Boom Res. 1971 p 297–305 refs (See N71-28363 16-02)

Avail: SOD $2.00; NTIS HC $6.00/MF $0.95 CSCL 20A

A parametric study is conducted to determine the effects of six pressure signature parameters on the rate of coalescence of the nose and wing shocks of a wing-body type of pressure signature. Definite trends of shock coalescence with each parameter are shown and it is clear that many combinations of the six parameters can be used to reduce sonic boom by retaining a near field signature to large distances from the aircraft. One example is given to show that a reduction in sonic boom can be realized by decreasing the pressure ahead of the wing shock. A relation between certain signature parameters and aircraft geometry is indicated. Author

N71-28386*# Aerosphysics Research Corp., Bellevue, Wash.
APPLICATION OF MULTIVARIABLE SEARCH TECHNIQUES TO THE DESIGN OF LOW SONIC BOOM OVERPRESSURE BODY SHAPES
D. S. Hague and R. T. Jones *In* NASA, Washington 3d Conf. on Sonic Boom Res. 1971 p 307 323 refs (See N71-28363 16-02)
(Contract NAS2-4880)
Avail: SOD $2.00; NTIS HC $6.00/MF $0.95 CSCL 20A

The use of relatively unconventional configurations produces significant maximum overpressure reductions in the mid-field. These configurations involve slope of area discontinuities, in the configuration 0 deg equivalent area distribution, and probably a canard arrangement. Solutions have been determined by the application of multivariable search techniques to a numerical model of the mid-field overpressure problem. It is recommended that the feasibility of employing a multiple arc distribution for an SST configuration is examined, possibly using the overall system design techniques developed by Petersen and Gregory. These configuration design techniques are also well suited to the multivariable search process. Author

N71-28387*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
STATUS OF RESEARCH ON BOOM MINIMIZATION THROUGH AIRSTREAM ALTERATION
David S. Miller *In its* 3d Conf. on Sonic Boom Res. 1971 p 325 340 refs (See N71-28363 16-02)
Avail: SOD $2.00; NTIS HC $6.00/MF $0.95 CSCL 20A

The application of heat field concepts to the sonic boom minimization problem is considered. Results indicate that finite rise time signatures are theoretically obtainable but require the creation of a carefully controlled heat field extending far ahead of and behind the airplane. An illustrative example for a representative SST configuration at cruise speed was treated. For a typical SST at cruise speed, it is estimated that, with direct burning, the bow and tail shock elimination could be accomplished with 60 percent additional fuel. Author

N71-28388*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MEASURED AND CALCULATED SONIC BOOM SIGNATURES FROM SIX NONAXISYMMETRIC WIND TUNNEL MODELS
H. L. Runyan, H. R. Henderson, O. A. Morris, and D. J. Maglieri *In its* 3d Conf. on Sonic Boom Res. 1971 p 341-350 refs (See N71-28363 16-02)
Avail: SOD $2.00; NTIS HC $6.00/MF $0.95 CSCL 20A

A wind tunnel experiment using six models has been conducted at M = 2.7 to study the growth of the pressure field as a function of distance from the model. The models consisted of two delta and four rectangular planforms including one model with side plates. The measured sonic boom pressure signatures are compared with calculated signatures based on the two- and three-dimensional flow theories. The results indicated a rapid transition from two dimensional flow characteristics to the three dimensional characteristics measured in the tests. In general, good agreement was obtained between the measured and calculated pressure field. The notable exception occurred for a model for which two dimensional flow was forced to exist within the confines of side plates. For that model, good agreement was obtained using two dimensional flow theory, particularly at the smallest distance of about one body length. At the farthest measurement point, five body lengths, better agreement was obtained using three dimensional flow theory. Author

N71-28389*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
VARIABILITY OF SONIC BOOM SIGNATURES WITH EMPHASIS ON THE EXTREMITIES OF THE GROUND EXPOSURE PATTERNS
Harvey H. Hubbard, Domenic J. Maglieri, and Vera Huckel *In its* 3d Conf. on Sonic Boom Res. 1971 p 351 359 refs (See N71-28363 16-02)
Avail: SOD $2.00; NTIS HC $6.00/MF $0.95 CSCL 20A

Sonic boom exposure patterns near their lateral extremities, particularly with regard to atmosphere induced variability, are investigated. A review of pertinent measurements and atmospheric refraction experiments shows that overpressures generally decrease and rise times are generally greater as lateral distance from the ground track increases. Overpressure variability is greater at locations 10 to 13 miles laterally from the ground track than for locations on the track for a range of Mach numbers and altitudes. The maximum measured overpressure values at 10 to 13 miles off the track for a range of altitudes and Mach numbers are of the same order of magnitude as those measured on the track. Author

N71-28390*# Boeing Scientific Research Labs., Seattle, Wash.
FINITE DIFFERENCE CALCULATION OF THE BEHAVIOR OF A DISCONTINUOUS SIGNAL NEAR A CAUSTIC
R. Seebass, E. M. Murman, and J. A. Krupp *In* NASA, Washington 3d Conf. on Sonic Boom Res. 1971 p 361 371 refs (See N71-28363 16-02)
Avail: SOD $2.00; NTIS HC $6.00/MF $0.95 CSCL 20A

Sonic boom overpressure signature predictions in the vicinity of a caustic are performed by extension to the caustic problem of a technique developed for transonic flows. This technique and some recent calculations are described. The goal of such calculations is to be able to theoretically predict pressure signatures such as those measured during flight tests where the reflected and incident signal have combined to produce large overpressure. Although the pressure signatures that occur in practice are essentially N-waves, it is clear that if the behavior of a single shock wave near a caustic can be calculated, then the behavior of more complex signatures there can also be calculated. Author

N71-28391*# Cornell Univ., Ithaca, N.Y.
THE ACCURACY OF THE LANDAU-WHITHAM SHOCK STRENGTH RULE IN SOME NEAR FIELD SITUATIONS
A. R. George and W. K. Van Moorhem *In* NASA, Washington 3d Conf. on Sonic Boom Res. 1971 p 373 384 refs (See N71-28363 16-02)
Avail: SOD $2.00; NTIS HC $6.00/MF $0.95 CSCL 20A

Several important effects in the near field for sonic boom problems are discussed. The Landau Whitham rule of simple pressure addition is seen to fail locally when waves reaching a shock are near the critical angle to it. The singularity occurring at the intersection of a conical flow field and a shock are canceled by reflected waves from the shock for finite Mach number shocks. However, the higher order terms necessary to determine the behavior at this point are not found by this technique. The propagation of waves through a nonuniform region before reaching a shock affects the strength of the waves and, therefore, the strength of the shock after its intersection with the wave. Regions of two dimensional flow bounded by a shock and three dimensional

waves are eliminated as the three dimensional waves propagate across the region. All of these effects produce significant variations in near field shock strengths. Author

N71-28392*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

ON THE EXTRAPOLATION OF MEASURED NEAR FIELD PRESSURE SIGNATURES OF UNCONVENTIONAL CONFIGURATIONS

Joel P. Mendoza and Raymond M. Hicks *In its* 3d Conf. on Sonic Boom Res. 1971 p 385-392 refs (See N71-28363 16-02)
Avail: SOD $2.00; NTIS HC $6.00/MF $0.95 CSCL 20A

Nose bluntness, large values of lift, and large Mach number have adverse effects on the prediction of sonic boom characteristics. A technique of extrapolating measured near field overpressure data from one altitude to larger altitudes circumvents many of the weaknesses of the Whitham theory. A number of cases are presented for which the Whitham theory either is not applicable or yields results that differ widely from the measured data. The extrapolation technique accurately predicts the sonic boom characteristics of the different configurations studied herein. Application of the extrapolation technique to overpressure data measured at Mach numbers as large as 4.63 can be made with some measure of confidence. Sonic boom levels of configurations producing strong shocks are accurately estimated. Author

N71-28393*# National Aeronautics and Space Administration, Washington, D.C.

PANEL AND OPEN CONFERENCE DISCUSSIONS

In its 3d Conf. on Sonic Boom Res. 1971 p 395-412 ref (See N71-28363 16-02)
Avail: SOD $2.00; NTIS HC $6.00/MF $0.95 CSCL 20A

The effects of aircraft shape, size, and operating conditions on sonic boom generation and propagation and of the way in which flight path variations and atmospheric conditions affect the propagation are outlined. Expected nominal overpressures are predicted by the use of current theoretical techniques, and the effects of atmospheric turbulence and inhomogeneities are estimated on the basis of statistical data from flight tests. Sonic boom minimization through aircraft shaping decreases overpressure levels to feasible supersonic flight conditions. G.G.

N71-28394*# National Aeronautics and Space Administration, Washington, D.C.

GENERAL REMARKS

In its 3d Conf. on Sonic Boom Res. 1971 p 413 441 refs (See N71-28363 16-02)
Avail: SOD $2.00; NTIS HC $6.00/MF $0.95 CSCL 20A

From results of numerous sonic boom tests of a wide range of wing-body configurations, it has been found that the available theoretical methods based on first order theory for calculating lift and sonic boom have limitations at moderately high Mach numbers that are sufficiently restrictive to compromise to some extent the effectiveness of these methods for low boom configuration research. Basic design problems encountered in transforming an optimum area distribution for low boom to equivalent lifting airplane configurations constitute calculation of vehicle lift distribution, accurate prediction of the F-function at higher supersonic Mach numbers, and lack of agreement between first order theory and experiments. G.G.

N71-28507# Southampton Univ. (England). Inst. of Sound and Vibration.

THEORETICAL STUDY OF HIGH FREQUENCY HELICOPTER ROTOR ROTATIONAL NOISE Final Technical Report, Mar. 1969-31 Aug. 1970

H. K. Tanna Sep. 1970 107 p refs
Grant DA-ERO-591-70-G001)
(AD-721661; ISVR-CR-70/3; ARDG(E)-E-1406) Avail: NTIS CSCL 20/1

The investigation deals with the radiation of rotational noise due to fluctuating forces on the rotar blades of a helicopter, with particular emphasis on studying the effects of chordwise and spanwise differential-pressure profiles. The variation of profiles with azimuth was studied as a possible source of higher harmonic rotational noise. The investigation is more useful at high tip Mach numbers, (>0.6), when rotational noise becomes subjectively more important than broadband noise; high forward speeds, when some peculiar loading profiles and their fluctuations with azimuth are observed; and higher frequencies of the acoustic spectra, where the wavelength of the sound radiated is comparable to the blade chord. Previous theories were modified to include the chordwise and spanwise differential pressure profiles. Computer programs were written to compute the r.m.s. value of mth harmonic of sound pressure at any observer position using rotor geometry and operating conditions, field point position relative to the rotor centre, and rotor blade differential-pressures at several chordwise and spanwise stations. A detailed study of the available measured aerodynamic loading data was carried out and it appears that the variation of chordwise blade loading profiles alone accounts for a significant part of the high-frequency rotational noise from helicopter rotors. Author (GRA)

N71-28881*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

AERODYNAMIC CHARACTERISTICS OF WING-BODY AND LIFTING-BODY CONFIGURATIONS OF HYPERSONIC CRUISE AIRCRAFT AT MACH 2.30 TO 4.63

Lloyd S. Jernell Washington July 1971 81 p ref
(NASA-TM-X-2287; L-7229) Avail: NTIS CSCL 01B

An investigation has been conducted to determine the effects of wing area and body-cross-section ellipticity ratio on the aerodynamic characteristics of a series of delta-planform wing-body configurations representing some of the principal features of a hypersonic cruise aircraft. The effects of body cross-section shape were also investigated for several lifting-body configurations. Data were obtained at angles of attack to approximately 24 deg for angles of sideslip of 0 deg and 3 deg. The Reynolds number was 9.8 million per meter (3 × 10 to the 6th power per ft). Author

N71-28883*# Bolt, Beranek, and Newman, Inc., Van Nuys, Calif.

EXPERIMENTAL ATMOSPHERIC ABSORPTION VALUES FROM AIRCRAFT FLYOVER NOISE SIGNALS

Dwight E. Bishop, Myles A. Simpson, and David Chang (Allied Res. Associates, Inc.) Washington NASA Jun. 1971 75 p refs
(Contract NAS1-8168)
(NASA-CR-1751; Rept-1868) Avail: NTIS CSCL 20A

A detailed analysis of the noise recorded on the ground during a series of 20 aircraft flyovers by two aircraft (a four-engine turbojet transport and a four-engine piston transport) during a single day of field measurements has been conducted to obtain experimental values of sound absorption. Noise levels recorded at five positions under and to the side of the flight path together with radar tracking data and meteorological information obtained on the surface and aloft were acquired during the field tests. Differences in one-third octave band noise levels observed at different ground positions for the same angle of radiation from the aircraft were utilized to obtain sets of absorption values which are compared to calculated values of sound absorption using both surface and altitude measurements of temperature and humidity. Author

N71-29023*# Tracor, Inc., Austin, Tex.

COMMUNITY REACTION TO AIRPORT NOISE, VOLUME 1

Washington NASA Jul. 1971 97 p refs
(Contract NASw-1549)
(NASA-CR-1761; T-70-AU-7454) Avail: NTIS CSCL 01C

A study is presented of the relationships of large numbers of variables--physical, psychological, and social--with community

reaction to the noise of aircraft around international airports in large U.S.A. cities. The seven major airports involved were Logan International-Boston, O'Hare International-Chicago, Dallas International-Dallas, Stapleton International-Denver, Los Angeles International-Los Angeles, Miami International-Miami, and Kennedy International-New York. Author

N71-28128* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

MECHANICALLY LIMITED, ELECTRICALLY OPERATED HYDRAULIC VALVE SYSTEM FOR AIRCRAFT CONTROLS Patent

John V. Foster, inventor (to NASA) Issued 11 Aug. 1959 7 p Filed 3 Oct. 1958 Cl. 121-38

(NASA-Case-XAC-00048; US-Patent-2,898,889; US-Patent-Appl-SN-765264) Avail: US Patent Office CSCL 01C

A surface control system has been designed which incorporates the advantages of both a mechanical operated control valve and an electrically controlled hydraulic servo valve. In general, this has been accomplished by a configuration in which a pilot's override linkage and the mechanical control valve are mechanically independent of the electrically controlled hydraulic servo valve. The system includes an hydraulic actuator having a movable member, a cylinder articulated to the control surface, the cylinder having tandem chambers in which are disposed a pair of double acting tandem pistons, anchored to the aircraft structure. Both sides of each piston is connected to a cognizant mechanical control valve for porting pressurized fluid from a single servo valve to either side of the corresponding piston depending on the desired motion of the actuator and the control surface.

Official Gazette of the U.S. Patent Office

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N71-28053*# Gulton Industries, Inc., Metuchen, N.J. Battery and Power Sources Div.

PRODUCTION OF UNIFORM NICKEL-CADMIUM BATTERY PLATE MATERIALS Quarterly Report, 13 Sep. - 12 Dec. 1969

Dec. 1969 43 p

(Contract NAS5-21045)

(NASA-CR-119000; QR-2) Avail: NTIS CSCL 10C

Experimental lots of sintered nickel plaques and impregnated plates were prepared in a production facility to study the effect of material and process variables on plaque and plate characteristics. The variables studied included sintering time, sintering temperature, slurry viscosity, sintering atmosphere, priming of substrate prior to slurry coating, and bulk density of the nickel powder. Measurements were made of plaque porosity, resistivity, mechanical strength, weight gain of active material and its percent utilization to evaluate the effect of the variables on these plaque and plate characteristics. Author

N71-28092*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EXPERIMENTAL EVALUATION OF SNAP-8 POWER CONVERSION SYSTEM STARTUP

Herbert G. Hurrell, Ronald H. Soeder, Roy A. Lottig, and Kent S. Jefferies Washington Jun. 1971 25 p refs

(NASA-TN-D-6381) Avail: NTIS CSCL 18N

The SNAP-8 power conversion system is turboelectric and operates on the mercury Rankine cycle. A startup test program was conducted on the power conversion system using a reactor simulator and a radiator simulator. Data from this program are presented and discussed. The data show that the power conversion system startup is dependable and that the resultant reactor temperature transients are well within the specified constraints. Author

N71-28278# Colorado Univ., Boulder. Dept. of Electrical Engineering.

SYNTHESIS OF HIGH SPEED HOMOPOLAR ALTERNATORS AND THEORY OF SOLID ROTOR ELECTRICAL MACHINES, PHASE DD. PART 1: OPTIMIZATION OF NONLINEAR HOMOPOLAR INDUCTOR ALTERNATORS

Edward Erdelyi Dec. 1970 257 p refs

(Contract DA-44-009-AMC-787(T))

(AD-721315) Avail: NTIS CSCL 10/2

The Homopolar Inductor Alternator is generally connected to semiconductor devices so that the load is a subtransient changing one. The commutating reactance, consisting in a large part of the armature reactance, should be made as small as possible. The HIA must also be efficient and light. A method denoted as geometric programming is used for optimizing the HIAs design. The properties of the designs, the objective function, subjected to nonlinear constraints, is transformed into its dual function with linear constraints. Optimization procedure is established first for minimum leakage reactance, maximum efficiency, and minimum weight separately and a compromise design obtained by the method of least squares. Two computer programs are developed -- one for the design analysis calculating the losses, weights, and reactances. The second program is used to solve the quasi-Poissonian equation of the vector potential in the cross section for determination of the performance characteristic at any saturation. Author (GRA)

N71-28413*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

OPTIMUM PERFORMANCE SPACECRAFT SOLAR CELL SYSTEM Patent Application

Edward M. Gaddy, inventor (to NASA) 12 p Filed 18 Nov. 1970

(NASA-Case-GSC-10669-1; US-Patent-Appl-SN-90595) Avail: NTIS CSCL 10A

A spacecraft solar cell system including a switching circuit which comprises relay operated switches for changing a plurality of solar cells from a first series-parallel interconnection to a second series-parallel interconnection is disclosed. The relays are actuated by a command device which may be a telemetry receiver. A protection circuit comprising a photodiode is connected between the command device and the relays to ensure appropriate solar cell orientation when switching occurs. This prevents arcing across the relay switches. NASA

N71-28434# Army Electronics Command, Fort Monmouth, N.J.

SKID MOUNTED THERMOELECTRIC POWER SOURCE

Andrew Herchakowski Feb. 1971 24 p refs

(AD-721887; ECOM-3397) Avail: NTIS CSCL 10/2

A Skid Mounted Thermoelectric Power Source System for use with AN/TRN-26 Beacon Set is described. The system is comprised of three Thermoelectric Generators PP-6075( )/U (20 ampere 28 V dc power source), a Battery, Storage BB-607( )/U (a nickel-cadmium, vented type), a control panel and a collapsible skid mount. The skid mount thermoelectric power source system is to provide a portable 1.5 kW power source to supply the power required for the AN/TRN-26 Beacon Set when required to be made operational at the end of an air strip under emergency conditions. Author (GRA)

N71-28435# Army Electronics Command, Fort Monmouth, N.J.

SPECTRAL RESPONSE INVESTIGATION OF SILICON PHOTOVOLTAIC CELLS

Emil Kittl Mar. 1971 92 p refs
(AD-721888; ECOM-3401) Avail: NTIS CSCL 9/1

Results of an experimental analysis are presented which encompass measurments of the absolute value of the spectral response of silicon photovoltaic cells over a wide range of incident monochromatic radiation intensity. The cells, a diffused-junction, single-crystal type, contained a dense contact grid pattern. This design provided high power density output at high intensity radiation levels. Three experimental approaches were used ranging in incident photon current from 0.1 micro Angstrom/sq cm to 1 Angstrom/sq. cm. For the low-intensity radiation levels, the beam from a prism-monochromator illuminated the silicon cell. At medium radiation levels, a tungsten-iodine standard lamp was combined with twenty-nine narrow-band interference filters to provide quasi-monochromatic radiation. At high radiation levels, a pulsed xenon discharge lamp was used with the same set of interference filters. A broadband, thermocouple radiation detector provided for the simultaneous measurement of the incident radiation and the silicon-cell output current. Measurement of effective carrier lifetime served as a means for explaining differences in the spectral response behavior between the P+/N and N+/P cell types. Results from experiments with high-intensity chromatic light sources are also reported which indicate the high output power potential of the silicon cell. Author (GRA)

N71-28436# Clevite Corp., Cleveland, Ohio.
RESEARCH ON THE OPERATING AND FAILURE MECHANISMS IN CdS SOLAR CELLS Final Technical Report, 1 Jun. 1969 – 31 May 1970
L. R. Shiozawa, F. Augustine, and W. R. Cook, Jr. Sep. 1970 149 p refs
(Contract F33615-69-C-1732)
(AD-722112; ARL-70-0169) Avail: NTIS CSCL 10/2

The operating and failure mechanisms of Cu2S: CdS thin film solar cells were examined further during the past year. The short circuit current of pilot production cells was found to be sensitive to the uniformity of Zn plating and to the texture of the metallized plastic substrate. Extensive literature and experimental studies on the various forms of cuprous sulfide were carried out. Author (GRA)

N71-28579* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HEAT ACTIVATED CELL Patent
Jacob Greenberg, inventor (to NASA) Issued 6 Apr. 1971 4 p Filed 20 Dec. 1968 Cl. 136-83; Int. Cl. H01M21/00, 17/06
(NASA-Case-LEW-11359; US-Patent-3,573,986; US-Patent-Appl-SN-787911) Avail: US Patent Office CSCL 10C

A heat activated electromotive force (EMF) cell having an anode formed of aluminum and a cathode comprising an oxidizing material such as sulfur, is described. The cathode material is supported in a container or in a matrix such as porous carbon. An aluminum salt layer electrolyte such as AlCl separates the anode from the cathode. To minimize vaporization of the aluminum salt, a alkali halide salt may be mixed therewith. The cell may be operated at temperatures up to a point where either the cathode material or the electrolyte is molten.
Official Gazette of the U.S. Patent Office

N71-28588 California Univ., Los Angeles.
THERMAL BEHAVIOR AND DESIGN OF CELLULAR MATRIX-POROUS BED SOLAR THERMAL CONVERTERS
Olufemi Akintonde Lalude (Ph.D. Thesis) 1969 339 p
Avail: Univ. Microfilms Order No. 70-14299

Studies of thermal performance of honeycomb structures when they are used to protect solid absorbers with no fluid transpiration through the honeycombs as well as porous absorbers with fluid transpiration through the honeycombs and absorbers were made. In the case of no fluid transpiration, a simple theoretical model which assumed uncoupled heat transfer by radiation, conduction, and free convection tended to underpredict temperature distribution in an effective emittance from the rectangular honeycombs with clear resin-overcoated-aluminized paper walls. In the case of air transpiration, a theoretical model was found to agree quite well with results of tests performed with an experimental module fitted with a number of rectangular honeycombs. The temperature distribution in and the thermal performance of honeycomb-porous bed solar thermal converters of the transpiration type were predicted using a theoretical model. The coupled integral energy equations obtained by carrying out energy balances on the various converter componnets were solved by the method of undetermined coefficients(collocation). Dissert. Abstr.

N71-28659*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NASA/GSFC BATTERY WORKSHOP, 1970 Transcript of Proceedings
[1970] 254 p Conf. held at Greenbelt, Md., 16 Nov. 1970
(NASA-TM-X-67200) Avail: NTIS CSCL 10C

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N71-28660*# Bell Telephone Labs., Murray Hill, N.J.
A NEW PROCESS IN PLATE MANUFACTURING
Richard L. Beauchamp *In* NASA. Goddard Space Flight Center NASA/GSFC Battery Workshop, 1970 p 10 - 34 (See N71-28659 16-03)
Avail: NTIS CSCL 10C

A new electrochemical technique is described in which the amount of active material introduced into a sintered nickel plaque is significantly higher than that obtained under normal operating conditions. The preparation of cadmium electrodes by electrochemical impregnation at high temperatures is discussed. Advantages of this high temperature impregnation process are: (1) shorter impregnation time; (2) improved distribution of active species at a respectable loading; (3) greater utilization of active material in a sealed state; and (4) process amenable to continuous automatic processing. A.L.

N71-28661*# Tyco Labs., Inc., Waltham, Mass.
NICKEL CADMIUM PLAQUES AND PLATES

John M. Parry *In* NASA. Goddard Space Flight Center NASA/GSFC Battery Workshop, 1970 p 34 - 65 (See N71-28659 16-03)
Avail: NTIS CSCL 10C

Results are presented of chemical analyses conducted on the active materials of nickel cadmium battery plates. These were conducted for quality control purposes and for making comparisons between different methods of impregnation and varying conditions in the impregnation methods. A.L.

N71-28662*# Comsat Corp., Clarksburg, Md.
EXTRACTION OF THE NEGATIVE PLATE
James D. Dunlop *In* NASA. Goddard Space Flight Center NASA/GSFC Battery Workshop, 1970 p 65 - 71 (See N71-28659 16-03)
Avail: NTIS CSCL 10C

The test program evolved for analyzing nickel cadium cells for the Intelsat 4 program is described. Discussed are the electrical performance tests and the chemical analyses conducted to determine what actually goes on inside the battery. A.L.

N71-28663*# Comsat Corp., Clarksburg, Md.
ELECTROLYTE ANALYSIS
G. Van Ommering *In* NASA. Goddard Space Flight Center NASA/GSFC Battery Workshop, 1970 p 71 84 (See N71-28659 16-03)
Avail: NTIS CSCL 10C

The technique used to analyze the electrolyte in the nickel cadmium batteries for the Intelsat 4 satellite is described. The technique consists of taking a sample and titrating it with hydrochloric acid, first to an end point of phenolphthalein to determine the KOH compound and half of the carbonate content, and then to a second end point with methyl violet indicators to determine the whole carbonate content from the weight loss of the plate stack of the cell. After drying the total weight of the electrolyte as well as the concentration of the KOH can be determined. The procedure used for the cadmium plates and the nickel plates are described. A.L.

N71-28664*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DATA ON PLATE WEIGHTS
Gerald Halpert *In its* NASA/GSFC Battery Workshop, 1970 p 84 93 (See N71-28659 16-03)
Avail: NTIS CSCL 10C

A nondestructive technique is described which can help predict ahead of time what kind of failures there would be, how the plates would operate, and what capacity you would have before the cells were assembled. Plaque and plate evaluations were performed by running a number of different types of tests measuring all the variables including surface area, pore size, and weight. The capacity was related to the plate weight and it was shown that capacity can be predicted. Data from a number of plate groups received from various manufacturers were compared with materials from OAO battery 32 and 33. Results indicate that although weight measurement and capacity measurement of flooded plates is not a highly scientific type test, it does give an indication of the capacity that might be expected from a group of plates and could be used as a criteria for plate selection prior to cell assembly. A.L.

N71-28665*# Bell Telephone Labs., Murray Hill, N.J.
PRECHARGE, PART 1
Dean W. Maurer *In* NASA. Goddard Space Flight Center NASA/GSFC Battery Workshop, 1970 p 96 111 (See N71-28659 16-03)
Avail: NTIS CSCL 10C

Results are presented of tests conducted on 23 ampere hour cells built to laboratory specifications to determine the effects of precharge, or charged cadmium, and cadmium hydroxide on the negative electrode. These investigations indicate that in addition to the X ampere hours of precharged cadmium put into the electrode to account for cadmium fading with cycling, a large excess of cadmium hydroxide, probably at least equal to the total precharge plus electrochemically inactive cadmium that the cell has, is required in order to assure reliable performance over an extended period of time. A.L.

N71-28666*# National Aeronautics and Space Administration Goddard Space Flight Center, Greenbelt, Md.
PRECHARGE, PART 2
Floyd Ford *In its* NASA/GSFC Battery Workshop, 1970 p 111 134 (See N71-28659 16-03)
Avail: NTIS CSCL 10C

Quantitatively measured data on the precharge that OAO battery cells received during construction are presented. The techniques used for measuring the residual precharge left in selected samples prior to washing and drying, and immediately after washing and drying are described. The precharge adjustment cycle which was conducted after reassembling the plate for the flight hardware into cells, and the addition of KOH, is also discussed. A.L.

N71-28667*# Grumman Aerospace Corp., Bethpage, N.Y.
LOW TEMPERATURE OVERCHARGE ON THE OAO BATTERY AND CELLS
Stephen Gaston *In* NASA. Goddard Space Flight Center NASA/GSFC Battery Workshop, 1970 p 134 158 (See N71-28659 16-03)
Avail: NTIS CSCL 10C

Four OAO battery end cell lots were reviewed with respect to the overcharge voltage characteristics, and the plus 30, plus 40 degrees temperature range. The low temperature overcharges were conducted at specific intervals and after cell reconditioning. Results indicate that nickel cadmium flight battery cells should be kept in a shortened state below room temperature and at low humidity conditions for the maximum possible periods to extend the oribital life. Also, an increase in the cell negative electrode capacity over the positive electrode capacity, generally known as the capacity ratio, should yield a longer time duration until the cell's hydrogen evolution voltage is reached. A.L.

N71-28668*# Heliotek, Sylmar, Calif.
CHARACTERIZATION OF CONTROL AND RECOMBINATION ELECTRODES
Harvey N. Seiger *In* NASA. Goddard Space Flight Center NASA/GSFC Battery Workshop, 1970 p 159 181 (See N71-28659 16-03)
(Contract NAS5-11547)
Avail: NTIS CSCL 10C

Results are presented of a discussion on the validity of conclusions reached in a study related to the characterization of control and recombination electrodes. The basic report dealt primarily with the fading mechanism associated in nickel cadmium cells and its effect on cycle life. The speaker's challenges to the report were responded to by a member of the team originally preparing the study. A.L.

N71-28669*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MARINER 71 BATTERIES
Sam Bogner *In* NASA. Goddard Space Flight Center NASA/GSFC Battery Workshop, 1970 p 181 197 (See N71-28659 16-03)
Avail: NTIS CSCL 10C

The basic handling plan for the batteries used in Mariner 71 spacecraft is presented. The plan covers installation in the spacecraft, environmental testing, temperature control, and storage. A.L.

N71-28670*# Naval Ammunition Depot, Crane, Ind.
ASPECTS OF CRANE PROGRAM
Don Mains *In* NASA. Goddard Space Flight Center NASA/GSFC Battery Workshop, 1970 p 198 229 (See N71-28659 16-03)
Avail: NTIS CSCL 10C

The NASA portion of the battery test facility at the Naval Ammunition Depot in Crane, Indiana, is discussed. Described are the testing and evaluation programs carried out at that location. Included in the presentation is a review of the various tests, reports, and information on what is meant by the various tests such as acceptance, life cycling, general performance, separator evaluation, storage, synchronous orbit, IMP battery evaluation, and some deep space probe tests. A.L.

N71-28671*# Eagle-Picher Co., Joplin, Mo.
A 25,000 CYCLE LIFE BATTERY
Earl Carr *In* NASA. Goddard Space Flight Center NASA/GSFC Battery Workshop, 1970 p 229 241 (See N71-28659 16-03)
Avail: NTIS CSCL 10C

The use of regression analysis as an aid to gain additional expected cycle life and reliability information from the data for cycle life tested cells is presented. This technique is being used to investigate the possibility of developing a 20 ampere hour, 25,000 cycle life, sealed nickel cadmium cell. A.L.

N71-28672*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NASA/GSFC 1970 BATTERY WORKSHOP, SESSIONS 3 AND 4 Transcript of Proceedings
[1970] 237 p refs Conf. held in Greenbelt, Md., 17 Nov. 1970
(NASA-TM-X-67186) Avail: NTIS CSCL 10C

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1. SEPARATOR SEALS: HARDWARE, SESSION 3 p 244 350 (See N71-28673 16-03)

2. NEW DEVELOPMENTS IN NICKEL-CADMIUM CELL TECHNOLOGY AND ADVANCED ENERGY STORAGE TECHNIQUES, SESSION 4 p 351 454 (See N71-28674 16-03)

N71-28673*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SEPARATOR SEALS: HARDWARE, SESSION 3
In its NASA/GSFC 1970 Battery Workshop [1970] p 244 350 refs (See N71-28672 16-03)
Avail: NTIS CSCL 10C

The design and fabrication of separators and seals for storage batteries are described. Some of the materials discussed are: nonwoven polyamides; polypropylene woven cloth; Cerex; nylon; and metal ceramics. Also described are modifications made to the Ziegler seal and some of the thermal cycle tests used to evaluate seals. A.L.

N71-28674*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NEW DEVELOPMENTS [IN NICKEL-CADMIUM CELL TECHNOLOGY AND ADVANCED ENERGY STORAGE TECHNIQUES], SESSION 4
In its NASA/GSFC 1970 Battery Workshop [1970] p 351 454 (See N71-28672 16-03)
Avail: NTIS CSCL 10C

Research and development progress, new technology, and test techniques related to energy storage devices are discussed. Described in detail are: (1) pressure monitoring of cells by use of strain gages; (2) sealable experimental cell cases for nickel cadmium cells; (3) porous nickel plaque of honeycomb structure; and (4) silver zinc storage cell usage and developments. A.L.

N71-28680# Tennessee Univ., Tullahoma. Space Inst.
FLUCTUATIONS IN SERIES CONNECTED OPEN CYCLE MHD GENERATORS
J. B. Dicks, Jr., Y. C. L. Wu, Mary Hall Scott, and E. M. Murray 2 Feb. 1971 15 p refs Presented at the 5th Intern. Conf. on Magnetohydrodynamic Elec. Power Generation, Munich, 19 23 Apr. 1971
(Contract F44620-69-C-0031)
(AD-721454; AFOSR-71-0843TR) Avail: NTIS CSCL 10/2

Fluctuations are present in MHD generators as stated previously in the literature. Attempts to relate these fluctuations to magnetoacoustical waves predicted by theory have not been successful. In this paper one describes another approach to fluctuation analysis. The theoretical and experimental methods used here are those of signal analysis involving functions such as probability density, cross-correlation, auto-correlations and power spectral density. It was found that the fluctuations in Hall voltage, electrode current, temperature, and pressure were all random Gaussian in nature. The probable source of the fluctuations was traced to turbulent fluxuations in the electric sheath properties and to conductivity fluctuations in the channel. Application of probability theory and function space analysis provides a new way of measuring the Hall parameter in the generator. Additional understanding on the operation of series connected generators is obtained through the observation that the fluctuations in the generator output are much lower than those that would be expected from adding the fluctuations of individual electrodes. This indicated that the generator must be studied as a whole in order to understand its behavior and that investigations involving a few electrodes are not sufficient to determine the overall generator performance. Author (GRA)

N71-28718# Tennessee Univ., Tullahoma. Space Inst.
FACTORS EFFECTING THE PERFORMANCE OF DIAGONAL CONDUCTING WALL OPEN CYCLE MHD GENERATORS
Y. C. L. Wu, L. Crawford, R. Shanklin, J. Muehlhauser, and D. Molnar Feb. 1971 19 p refs Presented at Intern. Conf. on Magnetohydrodynamic Electrical Power Generation, 5th, Munich, 19 23 Apr. 1971
(Contract F44620-69-C-0031)
(AD-721455; AFOSR-71-0853TR) Avail: NTIS CSCL 10/2

A systematic study has been undertaken to attempt to evaluate gross factors effecting the overall performance of series connected generators. These factors include combustor performance, chemistry, magnetic field strength, Mach number, and electrode segmentation. The scaling law for the magnetic field is of the form (B - V sub d/ud) squared. Dimensional scaling was investigated by varying the segmentation ratio of electrode length to channel height. The results show that when the electrode length divided by the channel height is changed from the neighborhood of .12 to the neighborhood of .25 then the generator power output decreases by 15 percent over the entire load spectrum. Other studies involving gross generator behavior include an investigation of the effect resulting from the deposit of aluminum oxide and other combustion materials on the walls of the generator. No deterioration of performance was noted during this process. The addition of the powdered aluminum improved the generator performance. During the course of the experimental study, it was found that both the injector head and combustor are very critical to the performance of the generators. Author (GRA)

N71-28803# Tennessee Univ., Tullahoma. Space Inst.
THE INFLUENCE OF ELECTRODE DROP ON CURRENT DISTRIBUTION IN DIAGONAL CONDUCTING WALL GENERATORS Scientific Interim Report
J. K. Koester, J. W. Stephens, J. F. Martin, and M. K. Nicholson 2 Feb. 1971 19 p refs Presented at the 5th Intern. Conf. on Magnetohydrodyn. Elec. Power Generation, Munich 19 23 Apr. 1971; sponsored by OECD European Nucl. Energy Agency and IAEA
(Contract F44620-69-C-0031)
(AD-722086; AFOSR-71-0910TR) Avail: NTIS CSCL 10/2

Current density and electrode drop distributions in the cross-sectional plane of the electrode in conducting wall generators

are studied experimentally and theoretically. A general electrode drop relationship depending only on current density and surface temperature is found empirically for cold electrodes. Large sheath drops are measured that behave qualitatively different with current density at the cathode and anode. This behavior is shown to cause large sidewall current flows and asymmetric current distribution on the electrode. A two-dimensional theory for cross-sectional variations in potential and current density is formulated with boundary conditions that allow for the electrode drop. A technique for solving the problem with nonlinear boundary conditions is given along with some solutions. Author (GRA)

N71-28954# Trapelo/West, Richmond, Calif.
A STUDY OF CONVENTIONAL AND UNCONVENTIONAL RADIAC POWER SOURCES Final Report
Ivan Sturman Dec. 1970 76 p refs
(Contract DAHC20-69-C-0122)
(AD-721662; TLW-6068) Avail: NTIS CSCL 10/2

Feasible substitutes for RADIAC power sources are identified and evaluated. The experimental methods and the results are described. Cautions that should be observed in the selection of RADIAC power sources are described. Cost comparisons are made of power sources considered to be suitable D-cell substitutes and conventional D-cells. Recommendations are made for RADIAC power sources and for further study topics. Author (GRA)

N71-29044* National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
ION-EXCHANGE MEMBRANE WITH PLATINUM ELECTRODE ASSEMBLY Patent
Hoyt McBryar and Herschel H. Jamison, inventors (to NASA) Issued 7 May 1968 3 p Filed 29 Dec. 1964 Cl. 136-86
(NASA-Case-XMS-02063; US-Patent-3,382,105;
US-Patent-Appl-SN-422096) Avail: US Patent Office CSCL 10A

An ion-exchange membrane and electrode assembly comprising an ion-exchange membrane between a pair of porous catalytic electrodes is discussed. A pair of thin plastic membranous sheets with finely divided platinum are superposed on to the catalytic electrodes. The thin plastic sheets are porous to hydrogen and oxygen, but are nonporous to complex ion-exchange groups of the ion-exchange membrane. The plastic sheets act as physical barriers to prevent escape of complex ion-exchange groups from the fuel cell and to prevent the flaking off of catalyst from the electrodes. The provision of platinum particles within the plastic sheets also increases the number of electrode reaction sites.
Official Gazette of the U.S. Patent Office

N71-29046*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SILICON SOLAR CELL ARRAY Patent Application
Americo F. Forestieri, Jacob D. Broder, and Daniel T. Bernatowicz, inventors (to NASA) 9 p Filed 26 Oct. 1970
(NASA-Case-LEW-11069-1; US-Patent-Appl-SN-83816) Avail: NTIS CSCL 10C

A heat sealable transparent plastic film, such as a fluorinated ethylene propylene copolymer, is utilized both as the protective cover and as the adhesive for mounting solar cells to a flexible substrate. A laminate comprising the substrate, a plastic film adhesive layer, the solar cell array, and a plastic film cover layer is bonded in a heated press. NSA

N71-29129* Electric Storage Battery Co., Raleigh, N.C.
ELECTRIC BATTERY AND METHOD FOR OPERATING SAME Patent
Augustus M. Chreitzberg, inventor (to NASA) Issued 14 Jan. 1964 3 p Filed 2 Jan. 1963 Cl. 320-13 Sponsored by NASA
(NASA-Case-XGS-01674; US-Patent-3,118,100;
US-Patent-Appl-SN-248985) Avail: US Patent Office CSCL 10C

One or more additional positive electrodes are assembled in a silver-zinc cell in such a manner that the additional positive electrodes are electrically isolated from the principal positive and negative electrodes comprising the cell element. The additional positive electrodes are connected to an additional positive terminal which can be electrically isolated from the principal positive terminal during the charging of the cell. Means are provided for connecting the additional positive terminal to the principal positive terminal by means of a shorting strap of nominal resistance. In operation, the cell is charged to its nominal cut-off with the additional positive terminal isolated electrically from the charging circuit. To reduce the initial voltage plateau provided by the divalent silver-oxide capacity of the cell the additional positive terminal is then electrically connected to the principal positive terminal through the shorting strap. In this manner, divalent silver oxide capacity of the cell is utilized to charge the silver in the additional positive electrode or electrodes to the monovalent silver state.
Official Gazette of the U.S. Patent Office

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N71-28068*# McMaster Univ., Hamilton (Ontario). Dept. of Psychology.
DURATION DISCRIMINATION OF BRIEF VISUAL STIMULI
Lorraine G. Allan, A. B. Kristofferson, and E. W. Wiens Jan. 1970 47 p refs
(Grants NGR-52-059-001; NRC APA-0112; NRC APA-0175)
(NASA-CR-118998; TR-38) Avail: NTIS CSCL 06P

The manner in which human observers discriminate a difference in duration between brief flashes of light was investigated. A decision theory analysis of the data indicated that the comparisons are based on the temporal information available in the stimuli, rather than on the difference in apparent brightness between them. Furthermore, it appears that the variability in the sensory states associated with a particular flash is independent of its physical duration, and that the expected value of the distribution of sensory states is a linear function of the physical duration of the flash.
Author

N71-28093# Joint Publications Research Service, Washington, D.C.
INFORMATION CHARACTERISTICS OF SYSTEMS AND THEIR RELATIONSHIP OF PSYCHOPHYSIOLOGICAL INDICATORS OF OPERATOR ACTIVITY
Yu. A. Ivashkin 28 May 1971 13 p refs Transl. into ENGLISH from Prib. Sist. Upr. (Moscow), no. 4, 1969 p 22 25
(JPRS-53244) Avail: NTIS

The capacity and content characteristics of information display systems are discussed and quantitatively expressed using the information theory frame of reference for combinatorial and schematic models. The information characteristics of display systems are related to psychophysiological indicators of human operator activity. Various factors are considered including operator instruction, training, and handling capacity; time for processing information; volume of displayed information; recognition time; and the type of display. J.M.

N71-28136*# McMaster Univ., Hamilton (Ontario). Dept. of Psychology.
DURATION DISCRIMINATION OF BRIEF VISUAL OFF-FLASHES
Marnie E. McKee, Lorraine G. Allan, and A. B. Kristofferson Jun.

1970 80 p refs
(Grant NGR-52-059-001)
(NASA-CR-119009; TR-42) Avail: NTIS CSCL 06P

The manner in which human observers discriminate the difference in duration between brief, visual off-flashes was investigated. Three observers were run in a two-alternative, single stimulus paradigm, and three in a two-alternative, forced-choice paradigm. In both cases the observer's task was to discriminate between a short and a long duration for two different values of initial duration and five different incremental durations added to the initial durations. The data indicated that performance increased as a function of the incremental durations and decreased as a function of the initial duration. Analysis of the data in terms of three models which assume that the observer uses temporal cues to make his judgment, and two which view him as using energy as the cue, revealed that none of the models could account adequately for the results obtained. The role of memory in the forced-choice situation was also investigated. One value of initial duration, two values of incremental duration, and four values of the inter-stimulus interval (ISI) were used. The results indicated no decrement in performance as a consequence of increasing ISI. Author

N71-28183*# Colorado State Univ., Fort Collins.
[EFFECTS OF CONTROLLED ATMOSPHERE CONSTITUENTS AND TRACE METALS ON METABOLISM AND METABOLICALLY VITAL ORGANS] Semiannual Status Report
30 Apr. 1970 65 p refs
(Grant NGR-06-002-075)
(NASA-CR-118955) Avail: NTIS CSCL 06P

A protocol is described for the determination of subtle effects resulting from exposure to a marginally stressful environment. The protocol is based upon the bioenergetic state of the organism. Utilizing this protocol, the metabolic effects of replacing nitrogen with argon, neon, or helium as the diluent gas were investigated. By measuring metabolic parameters in rats exposed to thermally isoconductive environments, comparing the above rare gases with nitrogen under normoxic conditions, changes were observed in metabolic rate which were inversely proportional to (1) the square root of the molecular weight of the diluent gas, (2) the solubility parameter of the diluent gas, and (3) the molar refraction of the diluent gas which is a measure of clathrate-forming capability. These are the identical parameters which show a relationship to the narcotizing capacity of the same gases under hyperbaric conditions. The relationships held for neon, nitrogen, and argon. They did not hold well for helium. It is concluded that diluent gases have both a direct metabolic effect which relates to the chemical characteristic of the diluent gas molecule and an indirect metabolic effect which relates to the thermal conductivity of the diluent gas as it cools the body surface of the animal, and the direct metabolic effect is significant. Author

N71-28187# School of Aerospace Medicine, Brooks AFB, Tex. Radiobiology Div.
EFFECTS OF SINGLE VERSUS MULTIPLE IRRADIATION UPON AVOIDANCE BEHAVIOR IN THE PRIMATE Technical Report, 1 Jan. – 30 Nov. 1970
Donald J. Barnes, G. Carroll Brown, and Richard A. Mason Mar. 1971 32 p refs
(AD-722053; SAM-TR-71-6) Avail: NTIS CSCL 6/18

Fourteen primates (Macaca mulatta) were trained to a high work-rate task, the Multiple Avoidance Program (MAP), and irradiated at the Texas A+M TRIGA reactor. Seven of these primates were exposed to a single 2,500-rad (midhead) pulse of mixed gamma/neutron radiation, while the remaining 7 animals received five 500-rad pulses spaced 15 minutes apart. The behavior of the two groups was monitored for 20 hours following the first pulse for each group, and the rate and quality of postirradiation performance were compared. In general, subjects of the multiple-exposure group appeared to maintain preirradiation levels of response following irradiation, though the variability of their behavior increased. Subjects of the single-exposure group demonstrated a greater degree of performance decrement on all recorded parameters than did their multiple-exposed counterparts. While it is impossible to directly extrapolate these data to the proble functioning of man in a radiation environment, the confirmation of mediation of effect by dose fractionation has important operational ramifications. Author (GRA)

N71-28206*# General Technical Services, Inc., Upper Darby, Pa.
GENERAL DYNAMICS OF THE PHYSICAL-CHEMICAL SYSTEMS IN MAMMALS
A. Iberall, M. Weinberg, and A. Schindler Washington NASA Jun. 1971 74 p refs
(Contract NASw-1815)
(NASA-CR-1806) Avail: NTIS CSCL 06C

Human thermoregulation is discussed with an examination of physical foundations. Several discrepancies between generally accepted hypotheses and physical constraints were resolved by the introduction of two other hypotheses. A consistent steady-state model is described and suggestions for testing the hypotheses are made. The concept of homeokinesis, a general view of dynamically sustained processes, ever-beating in living systems at all levels is presented. The physical-chemical problem of the chemical oscillator is described from its lowest level, the origin of life, and relate it to the higher systems levels. An experimental investigation of the presence of blood glucose oscillations is outlined. New data are presented which substantiate the existence of such oscillations and which begins to explore possible mechanisms involved. Author

N71-28247*# Stanford Research Inst., Menlo Park, Calif. Sensory Sciences Research Center.
EFFECTS ON MUSCLE TENSION AND TRACKING TASK PERFORMANCE OF SIMULATED SONIC BOOMS WITH LOW AND HIGH INTENSITY VIBRATIONAL COMPONENTS
Jerome S. Lukas, Mary E. Dobbs, and Donald J. Peeler Washington NASA Jun. 1971 32 p refs
(Contract NAS1-9286)
(NASA-CR-1781) Avail: NTIS CSCL 05E

To determine the relative contribution of the vibrational component generated in a room from simulated sonic booms on the electromyographic and performance responses of human subjects, four subjects were assigned randomly to each of the following groups: (1) paced tracing task, with booms and with relatively low intensity vibration (subject's chair and tracing table on a vibration-isolation platform); (2) paced tracing task, with booms, and with relatively high intensity vibration (subject's chair and tracing table on floor); (3) reading of light material, with booms, and with low intensity vibration; and (4) paced tracing task only. As a result of simulated sonic booms with a relatively high vibrational component, Group 2 obtained greater electromyographic responses and greater decrements in tracing performance than did Groups 1, 3, and 4. However, the statistical significance of the results is questionable because of the initial variability within and between the groups in contrast with earlier studies which employed subjects who were not adapted to these type noises. Author

N71-28248# Joint Publications Research Service, Washington, D.C.
SPACE BIOLOGY AND MEDICINE, VOLUME 5, NO. 1, 1971
O. G. Gazenko, ed. 17 Jun. 1971 140 p refs Transl. into ENGLISH of the publ. 'Kosmicheskaya Biologiya i Meditsina' Moscow, Medgiz., 9 Feb. 1971 p 1–92
(JPRS-53388) Avail: NTIS

Journal articles are presented on microbiological ecology of manned space flights, exobiology, sterilization, and life support systems. For individual titles see N71-28249 through N71-28267.

N71-28249# Joint Publications Research Service, Washington, D.C.

ANTI-INFECTION RESISTANCE AND IMMUNOBIOLOGICAL REACTIVITY IN MAN AND ANIMALS DURING HYPOXIC HYPOXIA

A. S. Kaplanskiy *In its* Space Biol. and Med., Vol. 5, No. 1, 1971 17 Jun. 1971 p 1-11 refs (See N71-28248 16-04)
Avail: NTIS

The literature covering the effects of hypoxic hypoxia on the anti-infection resistance and immunobiological reactivity of the human and animal body is reviewed. The data suggest that a hypoxic state induces a depression of animal resistance to bacterial and protozoal (but not viral) infections. Information on the absorptivity of the reticulo-endothelial system, phagocytic activity of neutrophils and macrophages, and antibody production under hypoxic conditions is included. Author

N71-28250# Joint Publications Research Service, Washington, D.C.

EFFECT OF INERT GASES ON THE ANIMAL BODY ACCOMPANYING HIGH CO2 CONCENTRATIONS AND HIGH AMBIENT TEMPERATURES

M. M. Osipova et al *In its* Space Biol. and Med., Vol. 5, No. 1, 1971 17 Jun. 1971 p 12-20 (See N71-28248 16-04)
Avail: NTIS

The physiological effects of helium-oxygen and argon-oxygen atmospheres containing 10 percent CO2 on the animal body (white rats) were studied at different ambient temperatures. In the temperature range 22-36 C the hypercapnic helium-oxygen atmosphere produced a marked cooling effect, whereas the similar argon-oxygen atmosphere exerted no noticeable effect. At 40 C animal heat exchange remained unaltered in all the atmospheres tested. The body temperature was found to be closely correlated with the heart beat of these animals. Author

N71-28251# Joint Publications Research Service, Washington, D.C.

CHANGES IN HUMAN WATER-MINERAL METABOLISM DURING WATER IMMERSION

L. A. Ioffe et al *In its* Space Biol. and Med., Vol. 5, No. 1, 1971 17 Jun. 1971 p 21-27 refs (See N71-28248 16-04)
Avail: NTIS

The effect of a 5-day water immersion test on the state of human mineral metabolism was investigated. An increase in diuresis and a change in urinary electrolyte excretion was observed. Variations in the renal function of water and ion excretion during the immersion experiment were accompanied by an increase in sodium and potassium content in the plasma and erythrocytes. During the first to third days after the experiment water and mineral excretion was delayed. During the experiment the hematocritic index increased substantially, and accordingly the blood concentration. Following the immersion test significant changes were noted in the hematocritic index in response to a standard load. Author

N71-28252# Joint Publications Research Service, Washington, D.C.

EFFECT OF IONIZED AIR ON ACETYLCHOLINE CONTENT AND CHOLINESTERASE ACTIVITY IN MICE OF DIFFERENT LINES

B. V. Anisimov et al *In its* Space Biol. and Med., Vol. 5, No. 1, 1971 17 Jun. 1971 p 28-31 refs (See N71-28248 16-04)
Avail: NTIS

Mice of different lines which were exposed to ionized air for 24 hours exhibited a reduced acetylcholine content in the intestine and an increased cholinesterase activity in the blood serum. Positive ions caused more distinct changes. Analysis of data in the literature and original findings suggest that one of the peculiarities of the physiological effect of atmospheric ions is their influence on the interaction between cholinergic and serotoninergic systems. Author

N71-28254# Joint Publications Research Service, Washington, D.C.

ANALYSIS OF OXYGEN PRODUCTIVITY OF PLANT CONVEYERS WITH DIFFERENT INTERVALS

Ye. V. Lebedeva et al *In its* Space Biol. and Med., Vol. 5, No. 1, 1971 17 Jun. 1971 p 37-42 refs (See N71-28248 16-04)
Avail: NTIS

Several approaches to the management of conveyer plantations in the cultivation of higher plants in bioregenerative life support systems are discussed. It is shown that oxygen production by the conveyer plantation method is sufficiently uniform if the conveyer interval is not over one-eighth of the total time of plant cultivation in the area of the planting. A reduction of the cultivation period may increase the total amount of oxygen produced. Author

N71-28255# Joint Publications Research Service, Washington, D.C.

DETERMINING LIPIDS, PROTEINS AND CARBOHYDRATES IN A CHLORELLA BIOMASS BY PYROLYSIS AND GAS CHROMATOGRAPHY

Yu. V. Pepelyayev et al *In its* Space Biol. and Med., Vol. 5, No. 1, 1971 17 Jun. 1971 p 43-49 refs (See N71-28248 16-04)
Avail: NTIS

The concentration of lipids, proteins and carbohydrates can be determined using the products of Chlorella pyrolysis at 450 C separated in a gas chromatographic column with aluminogel. The concentrations are determined by curves representing the correlations between the ratios of heights of the S sub 1 and S sub 2 peaks and ratios of concentrations of the investigated substances. The reproducibility of the S sub 1 and S sub 2 sums for the same sample is 2.5% and 3.9% (relative) respectively. The accuracy in determination is 2.1% (absolute) and 7.7% (relative) and the determination requires 30 minutes. Author

N71-28257# Joint Publication Research Service, Washington, D.C.

POSTFLIGHT METABOLISM AND RENAL FUNCTION OF CREW MEMBERS ON THE SOYUZ 6, SOYUZ 7, AND SOYUZ 8 FLIGHTS

I. S. Balakhovskiy et al *In its* Space Biol. and Med., Vol. 5, No. 1, 1971 17 Jun. 1971 p 57-67 refs (See N71-28248 16-04)
Avail: NTIS

Different metabolic parameters of crew members of the Soyuz-6, Soyuz-7, and Soyuz-8 spacecraft were studied before and after the flight. Functional changes were observed, but these constituted no health hazard. Weight losses were associated with an increased excretion of water and minerals, as indicated by the postflight retention of water, chlorine, sodium and potassium in the body. The blood content of cholesterol, lipid phosphorus and sugar remained unchanged. No symptoms of disorders in adrenal function were noted. Author

N71-28258# Joint Publications Research Service, Washington, D.C.

DIURNAL RHYTHM OF HUMAN PHYSIOLOGICAL FUNCTIONS AND PERFORMANCE IN A SCHEDULE WITH FREQUENT ALTERNATION OF SLEEP AND WAKEFULNESS

A. N. Litsov *In its* Space Biol. and Med., Vol. 5, No. 1, 1971 17 Jun. 1971 p 68-78 refs (See N71-28248 16-04)
Avail: NTIS

Fifteen healthy test subjects divided into three groups participated in experiments with frequently alternating work and rest cycles. The diurnal rhythms of basic functions in the human body gradually adjusted to the new stereotypes of work and rest cycles. The adaptation rate was dependent on the deviation of the new cycles from the normal rhythms, psychophysiological capacity of the test subjects for the required restructuring, their knowledge of the daily regime, strict adherence to the schedule, etc. It is concluded that schedules involving significant deviations from normal

rhythms can be used for only short periods, to be followed by more favorable cycles. Author

N71-28260# Joint Publications Research Service, Washington, D.C.

STUDY OF THE COMPOSITION OF AIR EXHALED BY MAN EXPOSED TO SOME EXTREMAL FACTORS

N. L. Sokolov et al *In its* Space Biol. and Med., Vol. 5, No. 1, 1971 17 Jun. 1971 p 86-90 refs (See N71-28248 16-04)
Avail: NTIS

The results of an analysis of contaminants present in the air exhaled by human subjects exposed to different stress effects (20 day bed confinement, 20 day starvation, 120 day diet of lyophilized foods, high temperature and humidity) are presented. Colorimetric, nephelometric and gas chromatographic methods were used. The most significant air changes were detected during exposures to prolonged starvation and high temperature (40 C). Author

N71-28261# Joint Publications Research Service, Washington, D.C.

EFFECT OF ADEQUATE VESTIBULAR STIMULI ON THE EXTERNAL RESPIRATION FUNCTION AND ACTIVITY OF RESPIRATION CENTER NEURONS

M. D. Yemelyanov et al *In its* Space Biol. and Med., Vol. 1, No. 1, 1971 17 Jun. 1971 p 91-98 refs (See N71-28248 16-04)
Avail: NTIS

The state of external respiration of subjects exposed to accelerations and resulting in vestibular stimulation, was investigated. There was found to be a correlation between the vestibular analyzer and external respiration; this is indicated by the inhibition of respiration during labyrinth stimulation. The functional state of respiratory neurons in the medulla oblongatus of cats subjected to oscillation was studied. Impulse activity of the neurons increased, inspiratory acts were shortened and expiratory acts were lengthened. Autocorrelation analysis revealed that the spike intervals regularly varied in conformity to the oscillation periods. Changes in the functional state of the respiration center due to the injection of lobeline or severing of the vagus nerve affected responses of respiratory neutrons during animal oscillation. Author

N71-28262# Joint Publications Research Service, Washington, D.C.

EVALUATING VESTIBULAR TOLERANCE

R. R. Galle et al *In its* Space Biol. and Med., Vol. 5, No. 1, 1971 17 Jun. 1971 p 99 107 refs (See N71-28248 16-04)
Avail: NTIS

Clinical symptoms in somatic and autonomic components of vestibular responses of 54 healthy male test subjects examined by the Coriolis acceleration test are reported. Also described is an approach to be used in evaluating human tolerance to vestibular stimulation. Vestibular intolerance is suggested by the development of third degree vestibular-autonomic reactions. With respect to the time of appearance and level of manifestation of the responses, it is suggested that three degrees of vestibular tolerance and three degrees of vestibular intolerance be discriminated, each of which can be characterized by certain clinical and physiological reactions. This approach to vestibular evaluations can be used in screening various types of personnel. Author

N71-28263# Joint Publications Research Service, Washington, D.C.

ANALYSIS OF FORCES ACTING ON THE RECEPTOR FORMATIONS OF THE SEMICIRCULAR CANALS DURING MAN'S MOVEMENTS IN ROTATING SYSTEMS

I. Yu. Sarkisov *In its* Space Biol. and Med., Vol. 5, No. 1, 1971 17 Jun. 1971 p 108 114 refs (See N71-28248 16-04)
Avail: NTIS

Accelerations affecting the receptors in the semicircular canals during man's movements in a rotating environment have been estimated by the vector analysis method. It is shown that only tangential accelerations of the rotating environment and man in this environment, as well as Coriolis accelerations caused by head movements or body rotation about an axis in the moving environment, result in a displacement of the cupula from an equilibrium state, thus inducing impulsation changes in the ampular nerve of the semicircular canal. Vector expressions for the mean resultant acceleration (force) applied to the cupula were derived. Numerical calculations of the mean Coriolis acceleration were made. Author

N71-28264# Joint Publications Research Service, Washington, D.C.

METHOD FOR STUDYING AN OPERATOR'S SENSOMOTOR ACTIVITY DURING PERCEPTION OF STIMULI IN A BROAD VISUAL FIELD

K. K. Ioseliani et al *In its* Space Biol. and Med., Vol. 5, No. 1, 1971 17 Jun. 1971 p 115 121 refs (See N71-28248 16-04)
Avail: NTIS

A model for the complicated sensomotor activity of a spacecraft pilot is depicted. While performing an experimental task at a very high speed the subject had to remember and record various stimuli and their specific characteristics, correct the results, and register them by pressing on the appropriate keys of a ten key adding machine. The procedure has been tested and can be recommended as a method for the psychological screening of aircraft and spacecraft pilots. Author

N71-28265# Joint Publications Research Service, Washington, D.C.

CHANGE IN RESISTANCE OF ANIMAL TISSUES DURING PROLONGED RESTRICTION OF MOTOR ACTIVITY

L. V. Serova et al *In its* Space Biol. and Med., Vol. 5, No. 1, 1971 17 Jun. 1971 p 122 124 refs (See N71-28248 16-04)
Avail: NTIS

Tissue resistance of immobilized rats was determined from sorption of dye in the diaphragm muscles. Already on the 30th day of hypokinesia there was a tendency to an increase in sorption activity which after 45 days was twice as high as in control animals. The difference in sorption levels between the tissues of the hypokinetic and the control rats after 60 days was about 65 percent; this proved a normalization of tissue resistance. It is concluded that an increase in the sorption activity of muscle tissue in animals during prolonged hypokenesia indicates intracellular dehydration. G.G.

N71-28266# Joint Publications Research Service, Washington, D.C.

EFFECT OF OXYGEN INADEQUACY ON THE ERYTHROCYTIC SYSTEM IN SPLENECTOMIZED DOGS

L. S. Gorozhanin *In its* Space Biol. and Med., Vol. 5, No. 1, 1971 17 Jun. 1971 p 125 127 refs (See N71-28248 16-04)
Avail: NTIS

Eleven splenectomized dogs in three different age groups were subjected at different times after the operation to single and repeated exposures to a reduced partial pressure of oxygen in the inhaled air equal to 56 mm Hg. The content of hemoglobin, number of erythrocytes and reticulocytes, hematocritic index, and acid tolerance of the erythrocytes were determined in the blood of these animals. In addition, bone marrow punctuates and the functional state of erythropoiesis were analyzed. Experiments confirmed the important role of the spleen as a depot of red blood corpuscles in the erythrocytic reaction to acute hypoxia and demonstrated the participation of this organ in the acute reticulocytic reaction. Splenectomy sharply slowed down the erythropoietic response in repeated exposures to low partial oxygen pressure. Author

N71-28283*# McMaster Univ., Hamilton (Ontario).
A STUDY OF ATTENTION AND PSYCHOLOGICAL TIME Final Report
Alfred B. Kristofferson May 1971 8 p refs
(Grant NGR-52-059-001)
(NASA-CR-119023) Avail: NTIS CSCL 05J

Brief summaries of research on attention and psychophysical time, the successiveness discrimination as a two-state quantal process, and sensory attention and duration discrimination of visual flashes are presented. J.M.

N71-28289# Army Aeromedical Research Lab., Fort Rucker, Ala.
EFFECT OF ISONIAZID ON PERFORMANCE
Richard O. Nossman and Mark A. Hofmann Feb. 1971 28 p refs
(AD-721624; USAARL-71-14) Avail: NTIS CSCL 6/15

Nine Aviators who converted from negative to positive on a tuberculosinh therapy. INH was administered prophylactically at dosage levels of 300 mg. per day. The tasks consisted of reaction time (auditory and visual), rotary pursuit tracking, mental multiplication and digit span. The data did not indicate that the drug adversely affected performance, on any of the tasks utilized. Author (GRA)

N71-28352 National Lending Library for Science and Technology, Boston Spa (England).
BODY WEIGHT, WING LENGTH, FAT DEPOSITS AND FLIGHT IN BIRDS [VES TELA, DLINA KRYLA, ZHIROVYE OTLOZHENIYA I POLET PTITS]
T. I. Blyumental et al Jan. 1971 10 p refs Transl. into ENGLISH from Zool. Zh. (Moscow), v. 49, no. 7, 1970 p 1069-1072
(NLL-RTS-6197) Avail: Natl. Lending Library, Boston Spa, Engl.: £0.80

Data are collected on the intraspecific relationships between lean weight and wing span for various avian species. Data are included for the large scale ringing of birds on the Kurshskaya kosa in the Baltic. Immediately after capture the birds were weighed, wing length measured, and their fat class determined visually. The classes are nil, poor, medium, and copious. The classes nil (no visible subcutaneous fat reserves, and copious (maximum fat reserves) for the species involved, are the only ones used in this study. Only spring and autumn migrating birds without traces of moult were used. Regressions for wing length-lean weight of nil class birds were calculated by the least squares method. The differences in the weight of birds belonging to different fat reserve classes are presented in tabular form. E.H.W.

N71-28447# Texas Technological Univ., Lubbock. Dept. of Industrial Engineering.
WORK PERFORMANCE UNDER THERMAL STRESS
J. D. Ramsey and A. Mortagy Feb. 1971 28 p refs Presented at the Brouha Intern. Conf. on Work Physiol., Quebec, 4 Feb. 1971
(Contract DAAD05-69-C-0102; Proj. Themis)
(AD-721595) Avail: NTIS CSCL 5/10

This is a report on some of the recent and current work in the environmental chamber at Texas Tech University. Specific studies discussed include: an investigation of variable temperature and diet effects on monitoring performance; an analysis of effects of localized heating of the head when performing simple motor and mental tasks in the cold; and a study of psychomotor task performance in the heat. Two additional investigations concerning vigilance task performance are currently in progress and are described herein. These studies represent different schemes of work and rest schedules as influenced by heat. Author (GRA)

N71-28476# Joint Publications Research Service, Washington, D.C.
SPACE BIOLOGY AND MEDICINE, VOLUME 5, NO. 2, 1971
O. G. Gazenko, ed. 24 Jun. 1971 139 p refs Transl. into ENGLISH of the publ. 'Kosmicheskaya Biologiya i Meditsina' Moscow, Medgiz., 17 Mar. 1971 p 1-90
(JPRS-53448) Avail: NTIS

Journal articles are presented on physiological effects of reduced gravity, restricted mobility, gamma irradiation, and magnetic field effects on humans and animals. For individual titles, see N71-28477 through N71-28496.

N71-28477# Joint Publications Research Service, Washington, D.C.
HUMAN MOVEMENTS UNDER LUNAR GRAVITATION CONDITIONS
V. A. Bogdanov et al *In its* Space Biol. and Med., Vol. 5, No. 2, 1971 24 Jun. 1971 p 1-13 refs (See N71-28476 16-04)
Avail: NTIS

The peculiarities of man's execution of different locomotor acts when reduced gravitation is simulated are presented. A classification of different stands and experimental apparatus making it possible to simulate reduced gravity is proposed, operation of these simulators is analyzed, and their positive and negative properties are considered. An attempt is made at a comparison of experimental data obtained during the simulation of lunar gravity under terrestrial conditions and published data on emergence of the Apollo 11 crew onto the lunar surface. Author

N71-28478# Joint Publications Research Service, Washington, D.C.
EFFECT OF RESTRICTED MOBILITY OF ANIMALS ON THE INTENSITY AND EXCRETION OF SOME GASEOUS PRODUCTS OF VITAL FUNCTIONS
V. V. Kustov et al *In its* Space Biol. and Med., Vol. 5, No. 2, 1971 24 Jun. 1971 p 14-19 refs (See N71-28476 16-04)
Avail: NTIS

The results of a study if the effect of relative restricted immobility on the intensity and excretion of gaseous products by male white rats are presented. It was demonstrated that 15 day reduced activity had an insignificant effect on the elimination of ketones and aldehydes and accelerated the elimination of carbon monoxide and ammonia. Author

N71-28479# Joint Publications Research Service, Washington, D.C.
EFFECT OF HYPOXIC HYPOXIA AND HYPERCAPNIA ON CALCIUM, INORGANIC PHOSPHORUS, AND TOTAL PROTEIN IN THE BLOOD OF RATS DURING HYPODYNAMIA
A. I. Volozhin *In its* Space Biol. and Med., Vol. 5, No. 2, 1971 24 Jun. 1971 p 20-27 refs (See N71-28476 16-04)
Avail: NTIS

The effect of adaptation to hypoxic hypoxia (7,000 meters) and hypercapnia (5 percent CO2) on the content of calcium, inorganic phosphorus, and total protein in the blood of rats performing normal and diminished activity was studied. The hypodynamic animals exhibited an increased calcium concentration and a decreased content of inorganic phosphorus and total protein. Hypoxic hypoxia used as a factor for increasing animal tolerance produced no normalization of these three parameters in hypodynamic rats. The experiments indicated that hypercapnia improved these parameters: (1) the level of inorganic phosphorus and protein in rats exposed to hypodynamia and (2) hypercapnia was higher than in rats exposed to hypodynamia alone. Author

N71-28480# Joint Publications Research Service, Washington, D.C.
STATUS OF ERYTHROPOIESIS IN DOGS EXPOSED TO GAMMA IRRADIATION IN DOSES SIMULATING CONDITIONS ACCOMPANYING PROLONGED SPACEFLIGHT
L. L. Semashko et al *In its* Space Biol. and Med., Vol. 5, No. 2, 1971 24 Jun. 1971 p 28-31 refs (See N71-28476 16-04)

Avail: NTIS

The results of studies of different aspects of erythropoiesis (lifetime of red blood cells, bone marrow production) of dogs exposed to cobalt 60 gamma irradiation for 2.5 years are presented. Two-year chronic irradiations with a dose of 62.5 rad/year, followed by exposures of 42 rad three times a year, shortened the half-life of erythrocytes. However, the damage processes were repaired, as could be judged from the absence of anemia, increase in bone marrow erythroid elements, and acceleration of bone marrow red blood cell production. Repair can be attributed to activated erythroid hemopoiesis. The changes produced by chronic irradiation alone were of a similar nature, but less distinct. Author

N71-28481# Joint Publications Research Service, Washington, D.C.

HEMATOLOGICAL EFFECTS IN DOGS EXPOSED TO CHRONIC AND REPEATED GAMMA IRRADIATIONS

T. Ye. Burkovskaya *In its* Space Biol. and Med., Vol. 5, No. 2, 1971 24 Jun. 1971 p 32 - 36 (See N71-28476 16-04)

Avail: NTIS

Studies of the morphological structure of the peripheral blood and bone marrow in dogs exposed to one year chronic irradiation in doses of 42 and 8 rad at four month intervals are analyzed. The data indicate that the exposure induces no serious homopoietic disturbances and the detected changes remain at the lower physiological level. The response to acute exposures with a dose of 42 rad involves myelopoiesis only, becoming less clearly expressed with an increase in the total dose. These data suggest that the formation of myelocytes is more sensitive than that of other blood corpuscles. Author

N71-28483# Joint Publications Research Service, Washington, D.C.

CELLULAR RESPIRATION DURING HIGH ALTITUDE ADAPTATION OF RATS

V. I. Dedukhova et al *In its* Space Biol. and Med., Vol. 5, No. 2, 1971 24 Jun. 1971 p 43 - 52 refs (See N71-28476 16-04)

Avail: NTIS

The effect of high altitude adaptation on the content of cytochromes and on the parameters characterizing oxidation and oxidative phosphorylation of cerebral homogenates is discussed. Some parameters were measured for hepatic mitochondria as a comparison. The differences in cerebral tissue respiration beginning with a study of the homogenate rather than with isolated mitochondria were investigated. Author

N71-28484# Joint Publications Research Service, Washington, D.C.

CHANGES IN THE SYMPATHICOADRENAL SYSTEM CAUSED BY EXPOSURE IN A PERMANENT MAGNETIC FIELD

B. M. Fedorov et al *In its* Space Biol. and Med., Vol. 5, No. 2, 1971 24 Jun. 1971 p 53 - 59 refs (See N71-28476 16-04)

Avail: NTIS

The effect of a permanent magnetic field on the sympathicoadrenal system in animals (rabbits) was investigated. The experiments produced a stimulating effect on the sympathetic nervous system. Twenty-four hour exposure to hypokinetic conditions considerably reduced the noradrenaline content in the hypothalamus and myocardium, but exerted no effect on the adrenaline content in the medullary layers of the suprarenals. Twenty-four hour exposure to a permanent magnetic field of 1,000 oe prevented any decrease in the noradrenaline content in the hypothalamus and myocardium of hypokinetic rabbits. Author

N71-28485# Joint Publications Research Service, Washington, D.C.

EFFECT OF AMYTETRAVITE AND ATP ON HEMOPOIESIS IN DOGS DURING REPEATED EXPOSURES AGAINST A BACKGROUND OF CHRONIC GAMMA IRRADIATION

V. D. Rogozkin et al *In its* Space Biol. and Med., Vol. 5, No. 2, 1971 24 Jun. 1971 p 60 - 65 refs (See N71-28476 16-04)

Avail: NTIS

The results of radiation experiments with three groups of dogs are presented. Two groups received a dose of 188.5 rad/year, whereas the third served as a control. The 30 irradiated dogs were administered radio-protective drugs: amytetravite and ATP. Hemopoietic parameters exhibited higher stability in response to the drugs. Author

N71-28486# Joint Publications Research Service, Washington, D.C.

SIMULATION OF EXPOSURE TO RADIATION APPLICABLE TO PROLONGED SPACE FLIGHTS

V. I. Popov et al *In its* Space Biol. and Med., Vol. 5, No. 2, 1971 24 Jun. 1971 p 66 - 70 refs (See N71-28476 16-04)

Avail: NTIS

The effects of exposing laboratory animals to chronic radiation exposure are discussed. The galactic cosmic radiation and solar flare radiation conditions were simulated from cobalt 60 gamma radiation. The experimental program provided for three acute irradiations per year for simulating the effect of radiation from solar flares in doses of 10 and 50 rem. The depth distributions of the radiation were used in computing the mean tissue doses received by the animals. Author

N71-28488# Joint Publications Research Service, Washington, D.C.

PRINCIPLES APPLICABLE IN FORMULATING WORK AND REST SCHEDULES FOR MAN IN SPACE

B. S. Alyakrinskiy *In its* Space Biol. and Med., Vol. 5, no. 2, 1971 24 Jun. 1971 p 76 - 83 refs (See N71-28476 16-04)

Avail: NTIS

A rationally formulated work and rest schedule for the efficiency and safety of space flights is discussed. The basic principle in formulating a rational work and rest regime is the rhythm principle. A work and rest schedule is an artificially created rhythm of sleep and wakefulness and those primarily working operations which constitute the content of man's occupational activity. High performance in any activity is ensured only in a case when the preprogrammed rhythm of life is correctly matched with the natural rhythms of psychophysiological functions characteristic of the body. Author

N71-28489# Joint Publications Research Service, Washington, D.C.

MECHANISM OF pH AND GAS REGULATION IN HUMAN BLOOD ACCOMPANYING A CHANGE IN PCO2 IN BREATHED AIR

V. V. Zhuravlev *In its* Space Biol. and Med., Vol. 5, No. 2, 1971 24 Jun. 1971 p 84 - 90 refs (See N71-28476 16-04)

Avail: NTIS

Six volunteers participated in a prolonged experiment in an isolation chamber with varying CO2 partial pressure. Acid-alkali equilibrium, pO2 and pCO2 were measured. It was concluded that the changes were of an individual nature and were related to the respiratory factor. These changes were compensated by responses of the external respiration and renal system. Author

N71-28490# Joint Publications Research Service, Washington, D.C.

EFFECT OF SPACEFLIGHT FACTORS ON HUMAN MUSCLE TONE

L. I. Kakurin et al *In its* Space Biol. and Med., Vol. 5, No. 2, 1971 24 Jun. 1971 p 91 - 99 refs (See N71-28476 16-04)

Avail: NTIS

Data from examinations of Soyuz-3, Soyuz-4, and Soyuz-5 crew members are presented. The effect of weightlessness on muscle tone was studied by measuring the firmness and bioelectric

activity of muscles. Prior to the flight muscle firmness was greater for the cosmonauts than for their associates. Subsequent to the flight they exhibited a decrease in the firmness and strength of posture muscles and an increase in reflex excitability at rest and bioelectric activity during work. Limb circumference remained unchanged. The nervous and muscular systems exhibited a greater reduction in reflex excitability in response to a physical load. Author

N71-28491# Joint Publications Research Service, Washington, D.C.

EXPERT MEDICAL EXAMINATION OF CIVIL AVIATION FLIGHT PERSONNEL FOR ATHEROSCLEROSIS

B. L. Gelman et al *In its* Space Biol. and Med., Vol. 5, No. 2, 1971 24 Jun. 1971 p 100 105 refs (See N71-28476 16-04)
Avail: NTIS

The predisposing factors for atherosclerosis are analyzed on the basis of examinations of 311 active civil aviation flight personnel suspected of atherosclerosis and coronary insufficiency, as well as 106 healthy aviators. Various methods employed in the early diagnosis of atherosclerosis are described. The most important methods are studies of lipid metabolism and electrocardiographic examinations accompanying functional tests. Criteria for evaluations of different indices are given. Recommendations for medical certification flight personnel afflicted with atherosclerosis are presented. Further research on methods to be used in the process of certifying atherosclerotic flight personnel are discussed. Author

N71-28492# Joint Publications Research Service, Washington, D.C.

CHANGES IN SOME HEMODYNAMIC PARAMETERS IN OVERWEIGHT FLIGHT PERSONNEL

V. M. Kondrakov *In its* Space Biol. and Med., Vol. 5, No. 2, 1971 24 Jun. 1971 p 106–110 refs (See N71-28476 16-04)
Avail: NTIS

The hemodynamic parameters of overweight (excess weight 6–23 kg) healthy pilots were studied. The examinations included 112 subjects in the age range 22–48 years, 53 of them serving as controls. The examinations revealed distinct differences in the basic parameters of total hemodynamics. In comparison with the controls, the young and middle-aged flight personnel exhibited reduced cardiac output, strength of the left ventricle, and volume rate of cardiac ejection. The greater the weight of the subjects, the more distinct were the changes. Parameters of vascular hemodynamics were within the normal range. The hemodynamic differences found in these flight personnel were probably related to the different initial level of circulatory system functional capacity. Various techniques making it possible to evaluate the functional state of the cardiovascular system are discussed. Author

N71-28493# Joint Publications Research Service, Washington, D.C.

CHANGES IN CARDIAC ACTIVITY DURING PROLONGED RESTRICTION OF MOTOR ACTIVITY

T. N. Krupina et al *In its* Space Biol. and Med., Vol. 5, No. 2, 1971 24 Jun. 1971 p 111 119 refs (See N71-28476 16-04)
Avail: NTIS

The results of clinical and experimental investigations of animals and human subjects conducted to study the mechanisms underlying the effect of hypodynamia on the cardiac function are presented. Clinical investigations which involved a 120-day bedrest experiment indicated that lessened activity resulted in deterioration of the automatic function and asthenization of the body at later stages. Hypokinetic experiments on rabbits revealed a drastic reduction in noradrenaline content in the hypothalamus at early stages and an inhibition of the adrenal function at later times. Ultrastructural investigations of myocardial cells revealed focal changes in contractile elements (myofibrillar swelling), trophic formations (reduced number of cristae in mitochondria) and increased permeability of the capillary endothelium. Changes in ECG waves which are typical of hypokinetic exposure can be attributed to disturbances in cardiac regulation and trophic support of the myocardium. Author

N71-28494# Joint Publications Research Service, Washington, D.C.

SOME ASPECTS OF THE HUMAN EXTERNAL RESPIRATION FUNCTION DURING WORK

A. S. Barer et al *In its* Space Biol. and Med., Vol. 5, No. 2, 1971 24 Jun. 1971 p 120–125 refs (See N71-28476 16-04)
Avail: NTIS

The relationship between respiration rate and volume and the minute volume of respiration was studied under a wide variety of physical loads, including extreme working conditions. Subjects wearing light coveralls or spacesuits worked on a bicycle-type ergometer and walked on a treadmill or along level hard ground. A well-expressed pattern of dynamic change in respiration rate and volume was observed, dependent on the intensity of the performed work. An increase in pulmonary ventilation is ensured during different parts of the work process by different combinations of reactions of respiratory act components: in some due to an increase in the respiration rate, and in others due to an increase in respiration volume. It is postulated that the basis for the described phenomena is a principle characteristic for all biological control systems: a minimizing of energy expenditures when the optimum effect is attained (in this case with respect to the minute volume of respiration). Author

N71-28495# Joint Publications Research Service, Washington, D.C.

DYNAMICS OF UROPEPSIN EXCRETION IN DOGS UNDER THE INFLUENCE OF SOME EXTREMAL FLIGHT FACTORS

G. I. Gurvich et al *In its* Space Biol. and Med., Vol. 5, No. 2, 1971 24 Jun. 1971 p 126 128 ref (See N71-28476 16-04)
Avail: NTIS

During the activity of a flier and cosmonaut in performing the most complex and emotionally stressed missions the blood and urine content of hormones from the cortex of the suprarenals is increased. An attempt was made to study uropepsin excretion of dogs under the influence of different extremal factors. The experiments were carried out on five female dogs using a bladder fistula. This made possible the periodic collection of urine for analysis at the required time under the best physiological conditions. Three weeks after the operation the dogs were familiarized with the experimental conditions. The experiments were initiated only after the dogs had ceased to react to the experimental conditions by a decrease in diuresis. Uropepsin was determined by the Sylvest West, Ellis and Scott method as modified by L. I. Idel'son on an ordinary day and after exposure to hypoxia (altitude 6,000 km, 30 minutes), a thermal factor (temperature 45 deg, 60 minutes), radial accelerations (up to 3 g, two minutes), and impact accelerations (8 g). The experiments were carried out in a pressure chamber, temperature chamber, on a centrifuge, and during catapult training. Author

N71-28496# Joint Publications Research Service, Washington, D.C.

DEPENDENCE OF INTENSITY OF PROPRIOCEPTIVE AFFERENTATION ON REGIONAL CIRCULATION

V. I. Savchuk et al *In its* Space Biol. and Med., Vol. 5, No. 2, 1971 24 Jun. 1971 p 129 130 (See N71-28476 16-04)
Avail: NTIS

Acute experiments on 52 cats under chloralose-urethane narcosis were used in investigating the bioelectric activity of thin bundles of afferent fibers in the muscular branch of the femoral nerve innervating the intermediate head of the quadriceps femoris under conditions of a controlled level of muscular circulation. The latter was achieved by perfusing a muscle from a donor, humorally isolated in situ, over sufficiently prolonged periods. The activity of

proprioceptive afferentation is determined to a considerable degree by the level of organic circulation. In a study of rigorously isolated groups of afferent fibers it was found that the greater the level of muscle circulation, the more intense is the spontaneous impulsation and the activation reaction to muscle dilatation by weights. Analysis of the collected data indicates that the flux intensity of spontaneous impulsation when the arterial pressure is 120 mm is two or three times greater than the level of spontaneous activity when the arterial pressure is 20 mm and corresponds to the intensity of the afferent flux which arises with muscle dilatation by a weight of 50 g when the arterial pressure is 20 mm. Author

N71-28857# School of Aerospace Medicine, Brooks AFB, Tex.
DIFFERENTIAL EFFECTS OF MULTIPLE AND SINGLE IRRADIATIONS UPON THE PRIMATE EQUILIBRIUM FUNCTION Technical Report, 1 Mar. – 1 Sep. 1969
Donald J. Barnes, G. Carroll Brown, and Zane M. Fractor Mar. 1971 23 p refs
(AD-722058; SAM-TR-71-7) Avail: NTIS CSCL 6/18

The Primate Equilibrium Platform (PEP) was utilized in an experiment at White Sands Missile Range, N. Mex., to determine the behavioral effects of single versus multiple irradiations. Eight trained primates (Macaca mulatta) were exposed to a single 1,500-rad pulse, and their performance was compared with the responses of a second group of 8 comparably trained primates receiving three 500-rad pulses spaced 1 hour apart. The subjects receiving multiple 500-rad pulses performed without appreciable change throughout the 20-hour postirradiation observation period, whereas those receiving the single 1,500-rad dose exhibited varying degrees of performance decrement. It was concluded that fractionation of dose within the limits explored herein had a definite mediating effect upon primate response to irradiation. Author (GRA)

N71-28839 National Lending Library for Science and Technology, Boston Spa (England).
ON THE ACQUISITION OF PSYCHOMOTOR SKILL DURING THE OPERATOR'S PERFORMANCE [O FORMIROVANII PSIKHOMOTORNOGO NAVYKA V OPERATOROSKOI DEIATELNOSTI]
V. A. Plakhtienko et al Jan. 1971 24 p refs Transl. into ENGLISH from Vopr. Psikhologii (Moscow), v. 15, no. 3, 1969 p 81 92
(NLL-RTS-6172) Avail: Natl. Lending Library, Boston Spa, Engl.: 2.30 ; 8 NLL photocopy coupons

The ability to control a motor coordination and concentration complex was studied in 50 individuals taught to perform tracking tasks. One handle and two foot pedals were required to control the psychomotor. The interdependance between the rate of the acquisition of a psychomotor skill and the psychophysiological kd motor characteristics of each individual was also investigated. The psychomotor skill was found to be acquired three stages, characterized by a decrease in error movements and a stability of time spent on one mistaken move, a decrease in both errors and the time spent on one mistaken move, and stabilization of errors and time spend on one error. In the first stage, the acquisition of tracking skill depends mostly on the sensori-intellectual level of readiness and the mobility of the nervous processes. In the second stage the rate of skill acqusition depends increasingly on the motor readiness of the operator, and in the third stage the rate depends on all factors with a prevalence of the sensori-intellectual factor. N.E.N.

N71-28855 Illinois Inst. of Tech., Chicago.
TRACER ANALYSIS OF RECIRCULATING SYSTEMS
Benedict Shang-Jeo Fu (Ph.D. Thesis) 1970 148 p
Avail: Univ. Microfilms Order No. 70-14930

The tracer dynamics of recirculating systems are described by the Volterra integral equation. Based on this formulation, an analytical non-parametric method is developed for analyzing the tracer response of the mammalian circulation. This method requires two point monitoring of the tracer response of the circulation. The whole body circulating blood volume is obtained without employing a model for the entire circulation, if the cardiac output is evaluated from the response curve of the central circulation. The method is applied to cases in which subjects are under normal conditions and under the condition of induced cardiogenic shock. A numerical Fourier transformation method is also developed for correcting the distortions of the response curve due to non-ideal injection and the sampling system. Dissert. Abstr.

N71-28970*# Techtran Corp., Glen Burnie, Md.
STEREOISOMERISM IN ANIMATE NATURE AND ITS ROLE IN PROCESSES OF THE ORIGIN OF LIFE ON EARTH [STEREOIZOMERIIA V ZHIVII PRIRODI - LI ROL'U PROTSESAKH POKHODZHENNIA ZHITTIA NA ZEMLI]
R. I. Khilchevska Washington NASA Jun. 1971 19 p refs Transl. into ENGLISH from Akad. Nauk Ukr. RSR Fiziol. Zh. (Kiev), v. 16, Nov. – Dec. 1970 p 810 – 817
(Contract NASw-2037)
(NASA-TT-F-13677) Avail: NTIS CSCL 06C

A review of scientific studies on the origin of life on Earth is presented. It discusses the significance of stereoisomerism in organic structures. It has an outline of contemporary conceptions of the successive stages of evolution which includes five eras, environmental conditions in each era, the basic sources of energy, and developments which occur in each era. Author

N71-29149# Joint Publications Research Service, Washington, D.C.
USE OF ELECTROENCEPHALOGRAM IN AVIATION PHYSIOLOGY PRACTICE
A. M. Klochkov et al 2 Jun. 1971 7 p refs Transl. into ENGLISH from Zh. Vysshei Nervnoi Deyatelnosti (Moscow), v. 21, no. 2, 1971 p 560 – 565
(JPRS-53269) Avail: NTIS

The informativeness of using spectral characteristics of the EEG and its derivative for evaluating changes in the EEG of a pilot during flight was studied. The EEG recordings were made in experiments simulating flight conditions. It is shown that the changes in the EEG caused by emotional excitation are reflected in the EEG power spectrum with sufficient clarity, but the EEG changes during intellectual activity by a pilot against a background of emotional excitation are not revealed clearly. The power spectrum of the EEG derivative is more effective in disclosing changes in the high frequency area, and it may be used to evaluate changes in the EEG caused by intellectual activity, even where the EEG contains slow oscillations. Author

N71-29200*# Translation Consultants, Ltd., Arlington, Va.
STUDY OF HISTOPATHOLOGY AND EVOLUTION OF CHRONIC OCCUPATIONAL X-RAY DERMATITIS OF THE FINGERS [ETUDE HISTOPATHOLOGIQUE ET EVOLUTIVE DES RADIODERMITES CHRONIQUES PROFESSIONNELLES DES DOIGTS]
F. Lagrot et al Washington NASA Jun. 1971 19 p Transl. into ENGLISH from Semaine Hop. Paris (Paris), v. 46, no. 13, Mar. 1970 p 866 – 876
(Contract NASw-2038)
(NASA-TT-F-13664) Avail: NTIS CSCL 06E

A systematic anatomico-clinical study of chronic professional radio-dermatitis of the fingers is reported. Out of 96 patients operated on 51 had epitheliomas and 1 had sacroma. These cancers were developed on the parts of the hand most exposed to radiations (backs of the last joints of the three axial fingers, with a juxta-ungual maximum(and signs of a severe radiodermatitis in the vicinity of the neoplasia were always found. The importance of vascular disorders of the dermis and dysplasia of the Malpighian layer of the epidermis in the onset of carcinoma is emphasized.

The changes are considered premalignant from their onset. The lesions are classified as follows:(1) Simple radiodermatitis, Grade 1 involutive, Grade 2 dysplasia; (2) X-ray dermatitis carcinoma in situ; (3) X-ray dermatitis with invasive carcinoma. The mechanism of this malignant degeneration from pre-cancer to carcinoma in situ and from the latter to invasive carcinoma is discussed. Author

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N71-28005# Federal Aviation Administration, Oklahoma City, Okla. Civil Aeromedical Inst.

BIODYNAMIC EVALUATION OF AIR TRAFFIC CONTROL STUDENTS BETWEEN 1960–1963

Michael T. Lategola Mar. 1971 12 p refs

(FAA-AM-71-8) Avail: NTIS

Between 1960–1963, a large number of ATC students in training at the FAA Aeronautical Center in, Oklahoma City underwent a broad spectrum of biomedical evaluations conducted by the Civil Aeromedical Research Institute. Approximately 1270 of these students were evaluated for physical fitness. Included in this evaluation were measurements of height, weight, pulmonary vital capacity, maximum breathing capacity and maximum aerobic working capacity. Principal findings were: (1) physical fitness levels comparable to general population norms of health and (2) expected parameter decrements with age. The age-related decrements in the measured physical parameters generally paralleled the ATC training failure rate. These data will serve as baselines for future evaluations of career ATC personnel in relation to job performance and preventive maintenance of optimum cardiovascular health. Author

N71-28006# Federal Aviation Administration, Oklahoma City, Okla. Civil Aeromedical Inst.

ACCEPTANCE TESTS OF VARIOUS UPPER TORSO RESTRAINTS

John J. Swearingen Feb. 1971 13 p refs

(FAA-AM-71-12) Avail: NTIS

The results of a study demonstrate that people can be motivated to utilize and, in fact, eagerly accept the use of upper torso restraint equipment for the prevention of head and chest injuries induced by flailing during crash decelerations, provided that specific design criteria are followed by structural engineers. By giving attention in the study to design of specially constructed restraint equipment to incorporate the maximum in features for comfort, neatness of appearance, ease of stowage, and ease of donning and escape, it was found that over 90% of the test subjects utilized these upper torso restraint systems throughout the 2-year test period. In contrast, only an estimated 3 to 5% utilization of the factory-installed torso restraint equipment in over 10,000,000 automobiles manufactured since 1 Jan. 1968 has been attained to date. It is suggested that general aviation aircraft manufacturers give consideration to these design criteria, along with incorporating inertia reels for ease of motion, before launching an extensive program for installation of upper torso restraint in light aircraft. Author

N71-28022*# Raff Analytic Study Associates, Inc., Silver Spring, Md.

NASA LIST OF POTENTIAL SPACE TOOLS AND EQUIPMENT

Lawrence B. Johnson, Eric Sander, and Stanley Lebow Washington NASA May 1971 350 p refs

(Contract NAS2-5073)

(NASA-CR-1760) Avail: NTIS HC$6.00/MF$0.95 CSCL 06K

A listing of space tools and equipment developed expressly for extravehicular and intravehicular space activities is presented. Descriptions are given of the purpose, previous solutions, current method of operation, related functional categories, performance, advantages and disadvantages, status, photographs and drawings, specifications, references, sponsor, manufacturer, developer, support equipment, and date of development for each space tool and equipment. The space tools and equipment are grouped by their specific functions: bonding and electroadhesor tools and maintenance equipment; cutting tools; hammers; illumination equipment; gas leak, pressure detection, restraint tools and maintenance equipment; tools maintaining electrical and electronic equipment; tool kits and tool sets; screwdriving and torquing tools; tube connection tools; and welders. Other data of interest to space mission planners and designers are also compiled. Author

N71-28094# Joint Publications Research Service, Washington, D.C.

MAN IN OUTER SPACE: PHYSIOLOGY AND PSYCHOLOGY

V. V. Parin et al. 8 Jun. 1971 18 p Transl. into ENGLISH from Priroda (Moscow), no. 4, 1971 p 9–17

(JPRS-53311) Avail: NTIS

Medicobiological problems both solved and unsolved in aerospace research are discussed. Life support systems and physiological factors for human habitation outside the earth environment are considered including vacuum, ionizing radiation, weightlessness, microclimate, and biochemical change effects. Space flight problems such as the formation and maintenance of a gaseous environment, nutritional requirements, movement biomechanics under weightless conditions, psychological effects of confined spaces, and psychophysiological responses to pitching motion are cited. J.M.

N71-28168# IIT Research Inst., Chicago, Ill.

EXPLORATORY DEVELOPMENT OF PARTIAL PRESSURE HELMET AND MOBILITY JOINTS FOR EMERGENCY PRESSURE SUIT OUTFITS Final Report 1 Jun. 1969–31 Aug. 1970

Joseph Slowik, Alfred Marcum and Marvin Burns Wright-Patterson AFB, Ohio AMRL Jan. 1971 65 p refs

(Contract F33615-69-C-1592)

(AD-720275; IITRI-J6181-FR; AMRL-TR-70-111) Avail: NTIS CSCL 6/17

Anistropic Dacron net prepared by distortion on the bias and locking with a polyurethane solution was used for expandable panels along with non-expandable fabrics and volume transfer bands to form several experimental joints. Combinations showing proper function in a single plane were not fully adaptable to multiple plane joints without resorting to bulky, rigid parts. The helmet incorporated a manually operated pressure visor, face-ear seals, and a multi-compartmented bladder system which does not cover the crown of the head thus cancelling helmet lifting forces. The helmet is functional and has been worn at 175 mm Hg pressure without undue discomfort. Total weight and bulk are low for a pressure helmet and high altitude trials have been successful. Head mobility (limited by omission of a rotary bearing and suit-bib overlap), better face-ear seals, and automatic visor closing would be attainable in a coordinated helmet/suit system development. Author (GRA)

N71-28188# Naval Personnel and Training Research Lab., San Diego, Calif.

DEVELOPMENT OF METHODS AND MATERIALS FOR SOLDERING TRAINING

L. S. Standlee, E. W. Matlock, and R. J. Harrigan Feb. 1971 32 p refs

(AD-720308; SRR-71-19) Avail: NTIS CSCL 5/9

Two parallel self-instructional packages were developed for teaching soldering rework on printed circuit boards. One package consisted of 12 five-minute sound films. The other consisted of a

168-page spiral bound book. The effectiveness of the self-instructional packages was compared with that of a parallel instuctor-taught course. Subjects for the comparison experiment consisted of 60 students in Basic Electricity and Electronics. Both self-instructional packages--film and book--were found to be effective media for learning soldering skills. No significant difference was found in the soldering skill gains of film-, book-, and instructor-taught students. The soldering book, though, would have the advantage of being simpler and less expensive to reproduce and to administer. Author (GRA)

N71-28190# Naval Personnel and Training Research Lab., San Diego, Calif.
DEVELOPMENT AND EVALUATION OF COMPUTER ASSISTED INSTRUCTION FOR NAVY ELECTRONICS TRAINING. 2: INDUCTANCE
Richard E. Hurlock Mar. 1971 34 p refs
(AD-720309; SRR-71-22) Avail: NTIS CSCL 5/9

The report presents results of development and evaluation of a second computer assisted instruction (CAI) course segment for basic electronics. Three tryout and revision cycles were included in the developmental phase. The test and evaluation phase compared achievement and time measures of students trained on the CAI segment with control students who received regular classroom instruction. Random selection procedures were used to choose 50 students for the CAI treatment and 180 students for the class instructed condition. At the end of the training all students took the standard school examination on this segment and a supplemental test which covered school objectives not tested by the school examinations in use at that time. The CAI students scored significantly higher than classroom controls on the supplemental test and did not differ from classroom students on the school examination. Combined scores for criterion referenced measure showed 10% higher achievement for CAI students. Training time for CAI students averaged 8.75 hours, a time savings of 48% compared to traditional classroom instruction. Author (GRA)

N71-28253# Joint Publications Research Service, Washington, D.C.
CEREALS AS A POSSIBLE COMPONENT OF THE AUTOTROPHIC LINK IN LIFE SUPPORT SYSTEMS
G. M. Lisovskiy *In its* Space Biol. and Med., Vol. 5, No. 1, 1971 17 Jun. 1971 p 32 - 36 refs (See N71-28248 16-04)
Avail: NTIS

Standard evaluations of higher plants selected for life support systems and experimental data concerning wheat productivity in an artificial environment, its biochemistry and compatibility with man, suggest that some cereals should be extensively studied to determine their possible use as polyfunctional components of closed ecological systems. Author

N71-28259# Joint Publications Research Service, Washington, D.C.
CREATING AN OPTIMUM 'COLOR CLIMATE' IN FLIGHT CRAFT CABINS
G. I. Gurvich et al *In its* Space Biol. and Med., Vol. 5, No. 1, 1971 17 Jun. 1971 p 79 - 85 refs (See N71-28248 16-04)
Avail: NTIS

The higher nervous activities of rats, monkeys and human subjects were studied during their adaptation to monochromatic light of red, yellow, green and blue colors. The data were used in investigating the psychophysiological equivalents of individual regions of visible light. The specific reactions to colors observed in the experiments are discussed in relation to their use in space cabin interiors. Author

N71-28281*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif. Advance Biotechnology and Power Dept.
TEST REPORT, FINAL TEST PLAN AND PROCEDURE: OPERATIONAL NINETY DAY MANNED TEST OF A REGENERATIVE LIFE SUPPORT SYSTEM
May 1971 512 p refs
(Contract NAS1-8997)
(NASA-CR-111882; MDC-G2282) Avail: NTIS HC $6.00/MF $0.95 CSCL 06K

The plan and procedures for conducting an operational ninety-day manned test of a regenerative life support system are presented. A space station simulator with all the systems and equipment necessary to support four men continuously for ninety days, without resupply, under simulated orbital conditions is described. The regenerative life support system utilizes components designed for zero gravity operation, with the entire system installed, serviced, and maintained by the flight crew. The life support system support equipment, facilities, and procedures are outlined as well as the logistics and supplies, crew selection, and medical and microbiological experiments. Instrumentation, data management, and pretest procedures are also covered for a five day and ninety day test. J.M.

N71-28284* Franklin Inst., Philadelphia, Pa. Research Labs.
SPACE RELATED BIOLOGICAL AND INSTRUMENTATION STUDIES Annual Report, Mar. 1970 - Mar. 1971
R. J. Gibson and R. M. Goodman Mar. 1971 75 p refs
(Contract NSR-39-005-018)
(NASA-CR-119024; A-B2299-5) Avail: NTIS CSCL 06D

The evaluation of pressure transducers for use with long-life implantable telemeters is discussed. Preliminary circuit designs for microwatt powering of the transducer were developed. Studies on miniature implantable pH electrodes are described as well as work on high-capacity photo-film recorders for biological data. Author

N71-28339# Dunlap and Associates, Inc., Darien, Conn.
HUMFACTS SYSTEM THESAURUS
Jan. 1971 420 p refs
(Contract DAHC04-69-C-0076)
(AD-721657) Avail: NTIS CSCL 5/2

The thesaurus contains words and phrases, concept-terms, which reflect the concepts to be indexed in support of the Human Factors, Engineering Information Retrieval (HUMFACTS) System. The concept-terms indicate structures which display the relationship between terms to at least two levels of detail in meaning. This developmental thesaurus is intended to serve as the authority list for subsequent indexing and retrieval processing but is not considered final. Author (GRA)

N71-28340# Naval Postgraduate School, Monterey, Calif.
INVESTIGATION OF THE EFFECTS OF INCREASED FLYING HOURS OF NAVAL POSTGRADUATE SCHOOL AVIATOR SKILL, KNOWLEDGE, AND STATISFACTION; A COMPARATIVE ANALYSIS
Michael Joseph Hanley (M.S. Thesis) Mar. 1971 125 p refs
(AD-721588) Avail: NTIS CSCL 5/9

Data reflecting the knowledge, skill, and satisfaction of aviators in combat readiness training flight status, was collected. The aviator sample consisted of one group flying the T-1A aircraft at a rate of 4-hours per month and another flying 8-hours per month. he data collection methods are described, and the results and conclusions from a comparative analysis are presented. Author (GRA)

N71-28358# Telluron, Santa Monica, Calif.
TRAINABLE SYSTEMS FOR CONTROL AND RECOGNITION APPLICATIONS Final Report
Charles E. Hendrix 31 Mar. 1971 8 p
(Contract N00014-69-C-0368)
(AD-721737; FR-1) Avail: NTIS CSCL 6/4

The research was aimed at the development of electronic circuitry which would mimic, in some degree, the function of the living nerve cell (hence the appellation neuromine) and which could be used as a building block in the construction of complex

information-handling or control systems. The systems thus constructed were expected to have the capability of learning to perform certain functions. The program had the threefold goal of development of a suitable neuromime circuit, development of useful trainable machines, and development of a design which would be economically feasible to manufacture in the large quantities which useful trainable networks would probably require. Author (GRA)

N71-28359# Army Behavior and Systems Research Lab., Arlington, Va.

IMPROVED SEARCH TECHNIQUES WITH PASSIVE NIGHT VISION DEVICES

James H. Banks, Jack J. Sternberg, Barry J. Cohen, and Henry De Bow Feb. 1971 44 p refs

(AD-722236; BESRL-TR-1169) Avail: NTIS CSCL 17/8

The NIGHT OPERATIONS Program is concerned with problems in optimizing human performance in relation to night vision devices and related sensors. In the furtherance of this research, studies are being conducted with passive night vision devices. Passive night vision devices developed for the Army have greatly increased night observation and target acquisition capabilities. Effectiveness of these devices, however, is highly dependent upon how and under what conditions they are used. The present study sought to determine whether new search techniques and procedures could increase the effectiveness of soldiers using passive night vision devices. The subjects (54 operators) using the Starlight Scope (SS) or the Night Observation Device, Medium Range (NOD) were given specialized search training and their training performance was compared with another group previously tested under the same conditions but without special training on search method and pattern. Author (GRA)

N71-28360# Army Behavior and Systems Research Lab., Arlington, Va.

EFFECTS OF SEARCH AREA SIZE ON TARGET ACQUISITION WITH PASSIVE NIGHT VISION DEVICES

James H. Banks, Jack J. Sternberg, John P. Farrell, William A. Dalhamer (Manned Systems Sci., Inc.), and Donald Vreuls (Manned Systems Sci., Inc.) Feb. 1971 48 p ref

(AD-722235; BESRL-TR-1168) Avail: NTIS CSCL 17/8

The NIGHT OPERATIONS Program is concerned with optimizing human performance in relation to night vision devices and related sensors. Specific aspects deal with determining performance effectiveness of sensor systems, factors which affect performance, and means of improving effectiveness. The present study describes research involving the use of such devices in assessing the effectiveness of soldier performance during night operations. The primary objective of the experiment was to investigate the effects of search area size on performance--as it interacts with a number of environmental, target, and human factors--and to determine the implications of findings for operational use, basis of issue; and search deployment, as well as for improvement of soldiers effectiveness in using these devices. Author (GRA)

N71-28482# Joint Publications Research Service, Washington, D.C.

ARTIFICIAL MINERALIZATION OF WATER REGENERATED DURING SPACEFLIGHT

M. I. Shikina *In its* Space Biol. and Med., Vol. 5, No. 2, 1971 24 Jun. 1971 p 37–42 refs (See N71-28476 16-04)

Avail: NTIS

A need for adding minerals to the water regenerated from human wastes during spaceflight is discussed. Experimental findings concerning the mineralization of regenerated water with solid-phase salts, powdered 2 $CaO \cdot SiO_2$, and salt tablets are presented. This method has certain advantages over current techniques, yielding drinking water with better organoleptic properties and superior physicochemical composition. Author

N71-28526*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

BIOTECHNOLOGY

Washington 1971 283 p refs Presented at the Proc. of a Conf. held at Blacksburg, Va., 14–18 Aug. 1967 Prepared in cooperation with Va. Polytechnic Inst.

(NASA-SP-205) Avail: SOD $2.75; NTIS CSCL 06B

Psychological, physiological, biological, medical, physical, and engineering factors associated with manned space missions lasting several months or more are examined. Biotechnological problems and possible solutions in the complex man machine systems required for long duration space flights are outlined. For individual titles see: N71-28527 through N71-28547.

N71-28527*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

FUTURE MANNED SPACE-FLIGHT IMPLICATIONS DERIVED FROM GEMINI

Samuel H. Hubbard *In its* Biotechnology 1971 p 3–10 (See N71-28526 16-05)

Avail: SOD $2.75; NTIS CSCL 06B

Bioastronautical achievements in the Gemini program and the resulting applications for future space programs are briefly outlined. Rendezvous and docking maneuvers as well as prolonged station keeping require space engines that may be periodically replenished and used for auxiliary propulsion of manned vehicles. Variable gravity engineering methods for future space explorers seem imperative; these methods include psychobiological and physiological considerations. G.G.

N71-28528*# Lockheed Missiles and Space Co., Sunnyvale, Calif.

PHYSIOLOGICAL AND PSYCHOLOGICAL PROBLEMS IN SPACE FLIGHT

William M. Helvey *In* NASA. Langley Res. Center Biotechnology 1971 p 11–20 (See N71-28526 16-05)

Avail: SOD $2.75; NTIS CSCL 06B

A history of the manned space flight experience is provided that categorizes the environmental factors to which an astronaut is subjected and the responses of the major body systems to each of these factors. Included are psycho-physiological factors within the spacecraft as well as those created by the space environment itself. G.G

N71-28529*# Douglas Aircraft Co., Inc., Santa Monica, Calif.

BIOTECHNOLOGY IN SPACECRAFT DESIGN

H. L. Wolbers *In* NASA. Langley Res. Center Biotechnology 1971 p 21–38 refs (See N71-28526 16-05)

(Contracts NAS1-3612; NAS1-2974)

Avail: SOD $2.75; NTIS CSCL 06B

A broad spectrum of earth orbital missions has been investigated during the past four years. These missions include those related to earth centered applications and those related to observations and measurements in the basic sciences, as well as missions related to general technological developments and to the support of extended space flight. These studies have indicated the practicality and research value of extended life space laboratories in the 30,000- to 40,000-lb class with crew complements of six to nine men. Based upon these studies, a prognostication of some of the potential biotechnology problems that will influence spacecraft design is presented and options for possible solutions to some of the problems that may arise during extended manned space flight are suggested. Author

N71-28530*# International Business Machines Corp., Bethesda, Md.

MAN AS AN EXPERIMENTER AND OPERATOR IN SPACE

P. A. Castruccio and G. N. Nomicos *In* NASA. Langley Res. Center Biotechnology 1971 p 39–54 (See N71-28526 16-05)

Avail: SOD $2.75; NTIS CSCL 06B

An attempt has been made to identify and analyze man's role as an experimenter and operator in space and to resolve questions about the precise region of application of man's capabilities. The potential space applications for the exploration and exploitation of space are considered. Man's potential role in space is then identified to justify his participation in the space program. A philosophy of man's applicability in space is analyzed to assess his capabilities to contribute to space tasks. A review of simulation results is presented for some specialized areas of man's application. The prognostication of man's suitability is discussed to specify the areas of his utilization. Simulation is proposed to obtain hard numbers on man's performance and determine the best machine aid required for support. Author

N71-28531*# Lovelace Foundation for Medical Education and Research, Albuquerque, N.Mex.

BIOLOGICAL AND ENGINEERING IMPLICATIONS OF SPACE-CABIN ATMOSPHERES

Emanuel M. Roth *In* NASA. Langley Res. Center Biotechnology 1971 p 55 - 76 refs (See N71-28526 16-05)

(Contract NASr-115)

Avail: SOD $2.75; NTIS CSCL 06B

Bioengineering tradeoff studies presented for optimal spacecraft cabin atmospheres in manned space flight are reported. Considered are basic physiological and pathological aspects, as well as the most prominent environmental and engineering factors in the selection of space cabin atmospheres specific for a mission. Weight savings are combined with weighted factors atmospheres specific for a mission. Weight savings are combined with weighted factors of physiological and engineering hazards and mission constraints in choosing the ideal atmosphere for any space operation. G.G.

N71-28532*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

ATMOSPHERIC-CONTROL SYSTEMS FOR EXTENDED-DURATION MANNED SPACE FLIGHT

Daniel C. Popma *In its* Biotechnology 1971 p 77 88 refs (See N71-28526 16-05)

Avail: SOD $2.75; NTIS CSCL 06B

Atmospheric control in spacecraft cabins for prolonged manned space missions requires carbon dioxide removal, water vapor removal, and provisions of the proper oxygen-nitrogen mixture. In addition to mission orientation, the configuration of the atmospheric control system depends upon the power penalty instituted by the regenerative system. Candidate processes and techniques for Earth orbital and Moon exploration missions are described and some estimates are given as to their weight, power requirements, and supplies for atmospheric control systems. G.G.

N71-28533*# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

MAN'S TOLERANCE TO TRACE CONTAMINANTS

A. A. Thomas *In* NASA. Langley Res. Center Biotechnology 1971 p 89 106 refs (See N71-28526 16-05)

Avail: SOD $2.75; NTIS CSCL 06P

Trace contaminant toxicity in manned spacecraft cabin atmospheres constitutes chemical components of metabolic processes, propellants, and industrial particles from the spacecraft interior. Establishing space threshold limits for man's tolerance to a contaminant mixture during a prolonged mission requires animal experimentation to prove exclusively the important factors in atmospheric contamination. The development of suitable mathematical models of chronic toxicity during long term continuous exposure is advocated for single and mixed contaminants in order to increase the values from animal experimentation with subsequent extrapolation to man. G.G.

N71-28534*# Indiana Univ., Bloomington. Medical Center.

SPACE-CABIN CONTAMINANTS: SOURCES AND CONTROL

J. C. Ross *In* NASA. Langley Res. Center Biotechnology 1971 p 107 112 (See N71-28526 16-05)

Avail: SOD $2.75; NTIS CSCL 06B

The theoretically possible sources of contaminants are man, machines, materials, equipment failure, extravehicular, and secondary generation. The major needs are prevention of contamination, rapid detection of toxic substances, adequate knowledge about TLV's for continual occupancy, and methods to maintain nontoxic levels of contaminants. Author

N71-28535*# Institute for Defense Analyses, Arlington, Va.

NUTRITION AND FOOD REQUIREMENTS FOR SPACE VOYAGE

Herbert Pollack *In* NASA. Langley Res. Center Biotechnology 1971 p 113 120 (See N71-28526 16-05)

Avail: SOD $2.75; NTIS CSCL 06B

The subject of nutrition and food management for space flight is a very broad one. The problems of short term and extended flights require separate solutions. The short term flights, up to 14 days, actually do not present a serious nutritional problem because man can survive without food for this period. In this period of time, work and performance degradation are not very great and no serious metabolic malfunctions occur. The problem that has occurred in the short term flights has been dehydration. The discussion of the possibilities of the longer term flights, up to 1000 days or more, presents an entirely different problem. Man must be supplied with adequate calories and all the other necessary nutrients. Author

N71-28536*# Douglas Aircraft Co., Inc., Santa Monica, Calif.

WATER MANAGEMENT FOR EXTENDED-DURATION MANNED SPACE MISSIONS

D. F. Putnam *In* NASA. Langley Res. Center Biotechnology 1971 p 121 132 refs (See N71-28526 16-05)

Avail: SOD $2.75; NTIS CSCL 06B

Two water management techniques are evaluated in manned chamber tests for application to extended duration space missions. The two techniques are the open cycle air evaporation system in which humidity control and water recovery from urine are accomplished in a single, combined system; and the multifiltration technique for wash water purification and filtering of humidity condensate and urine distillate. The tradeoff considerations that influenced the selection of these techniques are discussed. Also described are the chemical pretreatment of urine and the control of odors, trace contaminants, and microbes. Data on water quality are included. Author

N71-28537*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

MAN, HIS ENVIRONMENT, AND MICROBIOLOGICAL PROBLEMS OF LONG-TERM SPACE FLIGHT

Judd R. Wilkins *In its* Biotechnology 1971 p 133 144 refs (See N71-28526 16-05)

Avail: SOD $2.75; NTIS CSCL 06B

In manned space flight, microbiologists are concerned with a wide spectrum of possible problems associated with placing man in a closed environment for long periods of time. Progress is being made in many areas toward the goal of long duration manned space flight. A considerable portion of this effort is focused on the total space-cabin environment, including research and development on life support subsystems. Microbiological investigations in support of this entire program are summarized for the current status of this research and some potential problem areas are outlined. Author

N71-28538*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

LIFE SUPPORT SYSTEMS INTEGRATION

Warren D. Hypes *In its* Biotechnology 1971 p 145 164 refs (See N71-28526 16-05)

Avail: SOD $2.75; NTIS CSCL 06B

An optimized design of regenerative environmental control and life support systems requires integration at three levels: subsystem, system, and total spacecraft. Two types of subsystem level integration are desirable. One type is process integration that interfaces mass transfer, reaction rate control, and phase separation techniques. A second type is operational mode integration that interfaces selected techniques and design schemes for producing system operational flexibility. System level integration is paced by thermal balance considerations. These considerations involve the techniques of supplying heat to the endothermic processes and coolant to the system hardware and cabin environment. Tests have been conducted on a full scale research model integrated system. The tests have indicated that the regenerative processes are feasible. Author

N71-28539*# General Dynamics Corp., San Diego, Calif.
SPACE MISSION MODELING AND SIMULATION TECHNIQUES
C. B. Moore *In* NASA. Langley Res. Center Biotechnology 1971 p 165–184 refs (See N71-28526 16-05)
Avail: SOD $2.75; NTIS CSCL 06B

A mathematical model of a simulated space station mission is described and emphasis is placed on the handling of crew related factors in the model logic and library. Because of the flexibility of the model, a determination can be made of the sensitivity of mission effectiveness to a number of crew related factors such as crew task times, crewman proficiency, overtime allowables, work-shift lengths, work policies, crew rotation profiles, work-rest-sleep cycles, life support requirements, and crew illness. There is a discussion of a computerized methodology for use in comparing and balancing capabilities of astronauts versus the requirements and the demands of the total space mission. The methodology is illustrated as a planning tool in establishing requirements and capabilities of long duration space stations. Author

N71-28541*# Illinois Univ., Urbana.
PHYSIOLOGICAL HAZARDS OF EXTENDED SPACE FLIGHTS
Harlow W. Ades *In* NASA. Langley Res. Center Biotechnology 1971 p 193–198 (See N71-28526 16-05)
Avail: SOD $2.75; NTIS CSCL 06F

Space flights lasting months or years require advance investigation of possible physiological contingencies that may arise when the flight is 6 or 12 months from earth in an emergency that could not be handled by the crew. There are three main sources of information available that can be utilized in reducing the uncertainties. One of these is ground simulation of conditions aloft. The second is the mass of physiological data accumulated from the Gemini flights themselves. The third is the use of experimental flights with animal subjects that provide the opportunity to observe reactions directly under actual conditions, without human risk. Information that relates to projected flights of several months or more is evaluated and it is shown how the animal experimentation approach may be utilized to handle certain crucial questions that cannot be answered in any other way, short of using human astronauts as experimental subjects. Author

N71-28542*# Douglas Aircraft Co., Inc., Huntington Beach, Calif.
THE 1000-DAY MISSION: NULL GRAVITY AND MAN
W. J. White and D. E. Havens *In* NASA. Langley Res. Center Biotechnology 1971 p 199–206 (See N71-28526 16-05)
Avail: SOD $2.75; NTIS CSCL 06B

Existing biomedical information, in terms of 1000 days in space, is insufficient for extrapolation. Discussed is the need for research and development and for data that have significance for vehicle design. The roles of earth and orbiting laboratories in qualifying man for long duration missions are presented. Finally, fault tree analysis is introduced as a means of orienting biomedical research in the direction of mission parameters. Author

N71-28543*# Navy Dept., Washington, D.C.
MAN'S ROLE IN MISSION RELIABILITY
H. G. Moore *In* NASA. Langley Res. Center Biotechnology 1971 p 207–220 refs (See N71-28526 16-05)
Avail: SOD $2.75; NTIS CSCL 06B

In planning for future space flight systems, groundcrew and flightcrew reliability must be addressed as important system characteristics. Objective data on flightcrew or groundcrew performances are used as the basis for crew selection, mission mode decisions, and design concepts where decisions regarding human components or subsystems are needed. Author

N71-28544*# Texas Christian Univ., Fort Worth.
CAPSULE SOCIETY: NEW PROBLEMS FOR MAN IN SPACE ON LONG-DURATION MISSIONS
S. B. Sells *In* NASA. Langley Res. Center Biotechnology 1971 p 221–234 refs (See N71-28526 16-05)
(Grant NGR-44-009-008)
Avail: SOD $2.75; NTIS CSCL 06B

A social system model for the composition and organization of a spacecrew on long duration mission is formulated that considers the problems of human behavior during isolation and close confinement. The spaceship situation is envisioned as a miniature social system shaped by the following major dimensions: objectives and goals, value systems, personnel composition, organization, technology, physical environment, and temporal characteristics. It is proposed that all members of a spacecrew are equivalent to officers so that social distances are lessened between the crew. The inclusion of women in the complement of the spaceship is held not feasible in accordance with the American culture. Comparisons of the social system profile for the long duration spaceship with other relevant social system concepts are included. G.G.

N71-28545*# Kansas State Univ., Manhattan.
THE VISUAL REALM IN SPACE FLIGHT
John Lott Brown *In* NASA. Langley Res. Center Biotechnology 1971 p 235–254 refs (See N71-28526 16-05)
Avail: SOD $2.75; NTIS CSCL 06B

Man's presence on extended space missions is dictated by his unique effectiveness for coping with unusual situations. Critical elements in his performance are his sensory input channels. Visual problems that may be encountered in space flight are reviewed. The unique characteristics of the visual realm on space missions are discussed, from the instrument arrays and other aspects of space vehicle interiors to the extravehicular situations, from rendezvous and docking with other vehicles through landing or extraterrestrial bodies and exploration of their surfaces. The significant characteristics of the human visual system are reviewed in relation to the problems that may be encountered. Author

N71-28546*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
OPERATIONAL CONSIDERATIONS FOR EXTRAVEHICULAR ACTIVITY AS APPLIED TO FUTURE SPACE MISSIONS
Larry E. Bell *In its* Biotechnology 1971 p 255–274 (See N71-28526 16-05)
Avail: SOD $2.75; NTIS CSCL 06B

Basic guidelines in future mission planning are: (1) extravehicular activity should be planned as the primary means of accomplishing a given operational or experimental task only if there is no reasonable alternative; (2) tasks should be carefully planned to a timeline to allow for adequate rest periods; (3) rigid mounting restraints should be used wherever practical; and (4) use of umbilicals is practical when working within a fixed envelope of the spacecraft. This allows life support systems to be smaller and allows better utilization of spacecraft expendables, such as oxygen and power. Author

N71-28547*# National Aeronautics and Space Administration, Washington, D.C.
MAN IN THE OPERATIONAL ASPECTS OF SPACE MISSIONS
Charles W. Mathews *In its* Biotechnology 1971 p 275–283
(See N71-28526 16-05)
Avail: SOD $2.75; NTIS CSCL 06B

Nearly 2000 man hours of manned space flight experience have shown that man can readily adapt to this environment, as demonstrated in flights of up to 2 weeks; but of more importance, he can make significant contributions to the success of each mission. How man has been utilized in the space flights to date is described and the capabilities that have been demonstrared are illustrated. This information is then projected in consideration of near term future space exploration activities in which man will be engaged, and then in consideration of what might be expected in the longer term and the influence on design approaches and operational concepts. Author

N71-28549# Texas Univ., Austin. Dept. of Psychology.
BEHAVIOR OBSERVER'S MANUAL: PROJECT TEKTITE 2
Robert Helmreich, James Le Fan, and Richard Mach 20 Mar. 1971 51 p refs
(Contract N00014-67-A-0126-0001; Proj. Tektite 2)
(AD-721363; TR-13) Avail: NTIS CSCL 5/10

The report is a training manual for the collection of systematic observational data in a field situation. It is distributed to illustrate a methodology for collecting large amounts of data over long periods of time. Author (GRA)

N71-28550# Texas Univ., Austin. Dept. of Psychology.
THE TEKTITE 2 HUMAN BEHAVIOR PROGRAM
Robert Helmreich 15 Mar. 1971 63 p refs
(Contract N00014-67-A-0126-0001; Proj. Tektite 2)
(AD-721364; TR-14) Avail: NTIS CSCL 5/10

The report describes preliminary findings from a large-scale field research project involving continuous, systematic observations of 10 teams of aquanauts over a period of 182 days. Questions of field methodology are discussed, and the development of an effective new predictive instrument, the Life History Questionnaire, is reported. Author (GRA)

N71-28619* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
LOCOMOTION AND RESTRAINT AID Patent
Hubert C. Vykukal, inventor (to (NASA) Issued 8 Jun. 1971 6 p Filed 12 Dec. 1968 Cl. 104-1 Cl. 35-29; Cl. 104-139; Cl. 119-96; Cl. 238-1; Cl. 248-361; Cl. 272-70; Int. Cl. A63b71/00; Int. Cl. B61b13/00
(NASA-Case-ARC-10153; US-Patent-3,583,322; US-Patent-Appl-SN-783377) Avail: US Patent Office CSCL 06K

A locomotion and restraint aid for humans operating in conditions of zero gravity, comprising a spring biased tension member secured at one end to the operator and at the other to a trolley which moves along a track secured to a space vehicle is described. The track and trolley permit a limited range of movement, including walking, and the tension member simulates gravitational pull to provide stabilization during the performance of manual operation. Official Gazette of U.S. Patent Office

N71-28733# RAND Corp., Santa Monica.
TARGET DETECTION THROUGH VISUAL RECOGNITION: A QUANTITATIVE MODEL
H. H. Bailey Feb. 1970 36 p refs
(Contract F44620-67-C-0045; Proj. RAND)
(AD-721446; RM-6158/1-PR) Avail: NTIS CSCL 5/10

The report presents a model for describing analytically the capabilities and limitations of a human observer in the task of looking for and finding known or expected fixed objects. The description takes the form of six algebraic equations which together enable the user to estimate recognition probabilities as a function of the many parameters required to describe a specific situation. The model is tailored to the case of an airborne observer looking at terrain with or without optical aids or electro-optical sensors, but with prior knowledge of the approximate appearance of an object. Author (GRA)

N71-28877*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
TEST REPORT, TEST RESULTS, OPERATIONAL NINETY-DAY MANNED TEST OF A REGENERATIVE LIFE SUPPORT SYSTEM
May 1971 752 p refs
(Contract NAS1-8997)
(NASA-CR-111881; MDC-G2282) Avail: NTIS HC $9.00/MF $0.95 CSCL 06K

The operational 90-day manned test of a regenerative life support system is described. Overall and subsystem operational summaries are presented for atmosphere purification, supply, and pressurization, and water, food, and waste management. Crew and staff selction, training, and performance are outlined as well as the habitability evaluation, behavioral program, manned mission activity analysis, behavioral acoustics, EEG monitoring and sleep studies, glycerol food supplement, noninterference performance assessment, and critical task testing. Biomedical pretest, test, and post-test procedures are given with baseline data and test results. J.M.

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N71-28054*# Rocketdyne, Canoga Park, Calif.
DEGRADATION MECHANISM, HYDROCARBON POLYMERS Final Technical Report
C. L. Hamermesh Dec. 1970 27 p refs
(Contract NAS7-721)
(NASA-CR-119005; R-8401) Avail: NTIS CSCL 07D

A number of functional group terminated hydrocarbon polymers as well as chain extended products were exposed at 275 F for 400 hours both in the presence and absence of ammonium perchlorate. It was observed that for most of the polymers tested, relatively small weight losses occurred. This was also true for the chain extended products. By contrast, two polyisobutylenes (unextended) with residual functional groups (double bond or hydroxyl) at the chain ends were severly degraded. Chain extension of the hydroxyl polymer with toluene diisocyanate or pyromellitic dianhydride reduced the weight loss to the range observed with the other polymers. It was postulated that the sensitive end groups which cause unzipping of the polyisobutylene had been removed by the chain extension reaction. This was confirmed by simple endcapping reactions which do not result in chain extension. The products obtained gave only nominal weight losses. In all cases, elevated temperature exposure resulted in a substantial fraction of the polymer being rendered insoluble and the presence of AP increased the quantity of insoluble, presumably crosslinked, product Author

N71-28087# Gruman Aerospace Corp., Bethpage, N.Y. Materials and Structural Mechanics Section.
ENVIRONMENTAL EFFECTS ON POLYIMIDES
J. Russell and R. De Iasi Jun. 1971 17 p refs
(RM-510) Avail: NTIS

The effects of various reagents on the tensile properties of Kapton polyimide film were determined. It was found that the film degraded in the presence of strong acid or base. A variety of

organic solvents significantly altered the tensile strength and strain to failure of the film. These effects were attributed to combined solvolytic and hydrolytic activity. Seawater proved to be insignificantly different from distilled water in its chemical activity on polyimide. Author

N71-28177# Stanford Univ., Calif. Dept. of Chemical Engineering.
MOESSBAUER SPECTROSCOPIC STUDIES OF IRON Y ZEOLITES Final Report, 1 Apr. 1967 - 31 Mar. 1970
M. Boudart and R. L. Garten 1 Mar. 1971 13 p refs
(Contract DAHC04-67-C-0045)
(AD-721320; AROD-6950-8-C) Avail: NTIS CSCL 7/4

Mossbauer spectroscopic studies have provided a reasonably consistent picture of the structure and chemistry of iron exchanged Y zeolite. It has been demonstrated that the oxidation-reduction behavior of ferric and ferrous exchanged Y Zeolite is related and that the same chemical states of iron are formed in both materials. The reversible oxidation of the zeolite iron ions by oxygen adsorption may have important implications for catalytic oxidation. The exchange of iron ions into zeolites with different structures and silicon to aluminum ratios and the observations of reversible oxidation may allow the preparation of oxidation catalysts with unique properties and selectivity. Author (GRA)

N71-28258# Joint Publications Research Service, Washington, D.C.
EFFECT OF RARE EARTH METAL HYDROXIDES ON THE REACTION OF FORMALDEHYDE CONDENSATION INTO SUGARS
A. A. Berlin *In its* Space Biol. and Med., Vol. 5, No. 1, 1971 17 Jun. 1971 p 50 - 56 refs (See N71-28248 16-04)
Avail: NTIS

A review of the literature on catalysts for formaldehyde condensation into sugars is presented. Since every catalyst of this reaction has an ion radius, new catalysts are sought among reagents whose ion radius conforms to the required conditions. Several catalysts based on lanthanides are considered suitable. It was found that at 110 C thulium, dysprosium, erbium, europium, samarium, cerium and scandium hydroxides accelerate the formation of carbohydrates. Author

N71-28290# Joint Publications Research Service, Washington, D.C.
METHODS OF PRODUCING SUPERPURE INORGANIC SUBSTANCES
B. D. Stepin et al 1 Jun. 1971 495 p refs Transl. into ENGLISH of the book "Metody Pluchenlya Osobo Chistykh Neorganicheskikh Veshchestv" Leningrad, 1969 480 p
(JPRS-53256) Avail: NTIS HC$6.00/MF$0.95

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N71-28291# Joint Publications Research Service, Washington, D.C.
CLASSIFICATION OF COMPOUNDS. SUPERPURE COMPOUNDS
In its Methods of Producing Superpure Inorg. Substances 1 Jun. 1971 p 13 - 27 refs (See N71-28290 16-06)
Avail: NTIS HC$6.00/MF$0.95

Superpure inorganic substances are discussed from the standpoint of their chemical properties and the behavior of impurities. Substances may be categorized as pure, analytically pure, and chemically pure. Ultrapure substances, the behavior of whose impurities cannot be described by the laws of chemical thermodynamics will require a new category. A new method of classification for superpure inorganic substances is presented. P.N.F.

N71-28292# Joint Publications Research Service, Washington, D.C.
EFFECT OF FOREIGN CONTAMINANTS ON SUPERPURIFICATION PROCESSES
In its Methods of Producing Superpure Inorg. Substances 1 Jun. 1971 p 28 - 62 refs (See N71-28290 16-06)
Avail: NTIS HC$6.00/MF$0.95

The influence of foreign contaminants on the production of superpure inorganic materials is discussed. The limitations imposed on the production of semiconductor materials by the presence of contaminants is described. The performance of the superpurification process is dependent upon the correct choice of materials for the chemical apparatus and the degree of total isolation of the product from the atmosphere in all stages of the technological process. P.N.F.

N71-28293# Joint Publications Research Service, Washington, D.C.
CRYSTALLIZATION AND PRECIPITATION FROM SOLUTIONS
In its Methods of Producing Superpure Inorg. Substances 1 Jun. 1971 p 63 - 130 refs (See N71-28290 16-06)
Avail: NTIS HC$6.00/MF$0.95

Processes for crystallization and precipitation of impurities from chemical solutions are discussed. Subjects presented are: (1) basic indices of fractionation in crystallization processes, (2) determination of degree of crystallization of basic compounds from solution, (3) determination of ideal crystal purification coefficient, and (4) role of isomorphism in microimpurity fractionation processes. P.N.F.

N71-28294 Joint Publications Research Service, Washington, D.C.
ADSORPTION PURIFICATION METHODS
In its Methods of Producing Superpure Inorg. Substances 1 Jun. 1971 p 131 - 188 refs (See N71-28290 16-06)
Avail: NTIS HC$6.00/MF$0.95

The fundamental principles and applications of adsorption

purification methods are discussed. Adsorption can be used in purifying and drying of gases, vapors, and liquids; elimination of harmful contaminants and recuperation of solvents; fine purification of materials in solution; and extraction of small quantities of valuable metals. Adsorption phenomena are the foundation of new chromatographic methods of mixture separation. P.N.F.

N71-28295# Joint Publications Research Service, Washington, D.C.

ION EXCHANGE PRODUCTION OF SUPERPURE SUBSTANCES

In its Methods of Producing Superpure Inorg. Substances 1 Jun. 1971 p 189-234 refs (See N71-28290 16-06)

Avail: NTIS HC$6.00/MF$0.95

The application of ion exchange for the extraction of milligram quantities of impurities from solutions is presented. The chief obstacle to the adoption of ion exchange methods of producing superpure substances is the comparatively low mechanical and chemical stabilities of the ionites, particularly their solubility in the processed solution. The ion exchange method of purification is carried out exclusively under dynamic conditions in columns with a stationary ionite bed. P.N.F.

N71-28296# Joint Publications Research Service, Washington, D.C.

RECTIFICATION METHODS OF SUPERPURIFICATION

In its Methods of Producing Superpure Inorg. Substances 1 Jun. 1971 p 235-302 refs (See N71-28290 16-06)

Avail: NTIS HC$6.00/MF$0.95

Problems related to the application of various forms of rectification to the process of superpurification of inorganic materials are discussed. Subjects presented are: (1) theoretical fundamentals of the rectification process, (2) principal methods of determining relative volatility of limit dilute solutions, (3) principles of calculation of rectification processes, and (4) laboratory rectification installations and design principles of individual assemblies. P.N.F.

N71-28297# Joint Publications Research Service, Washington, D.C.

EXTRACTION

In its Methods of Producing Superpure Inorg. Substances 1 Jun. 1971 p 303-326 refs (See N71-28290 16-06)

Avail: NTIS HC$6.00/MF$0.95

The theory of the extraction process for the purification of inorganic materials is presented. The process is based on the solubility difference of the components in a two-phase system. The extraction process makes it possible to concentrate the analyzed material and to separate undesirable compounds that interfere with the analysis. Examples of the use of extraction for the superpurification of inorganic substances are reported. P.N.F.

N71-28298# Joint Publications Research Service, Washington, D.C.

ZONE MELTING

In its Methods of Producing Superpure Inorg. Substances 1 Jun. 1971 p 327-377 refs (See N71-28290 16-06)

Avail: NTIS HC$6.00/MF$0.95

The production of superpure substances by zone melting or zone recrystallization is discussed. Zone melting, in terms of reaching the highest purity, is the most effective of all ultrapurification methods. For this reason zone melting is used as the final stage of a multistage superpurification process. Subjects discussed are: (1) fundamental principles of zone melting, (2) basic factors that influence process efficiency, (3) variations of processes, and (4) equipment required to conduct the process. P.N.F.

N71-28299# Joint Publications Research Service, Washington, D.C.

ELECTROCHEMICAL METHODS OF SUPERPURIFICATION OF INORGANIC SUBSTANCES

In its Methods of Producing Superpure Inorg. Substances 1 Jun. 1971 p 378-406 refs (See N71-28290 16-06)

Avail: NTIS HC$6.00/MF$0.95

Electrochemical methods for superpurification of inorganic substances are discussed. Subjects presented are: (1) electrodialysis, (2) ion mobilities, (3) electrolysis employing solid cathodes and anodes, (4) precipitation of individual microimpurities, and (5) amalgam electrochemical process. P.N.F.

N71-28300# Joint Publications Research Service, Washington, D.C.

PRODUCTION OF SUPERPURE INORGANIC SUBSTANCES BY MEANS OF CHEMICAL TRANSPORT REACTIONS

In its Methods of Producing Superpure Inorg. Substances 1 Jun. 1971 p 407-418 refs (See N71-28290 16-06)

Avail: NTIS HC$6.00/MF$0.95

The application of chemical transport reactions to the production of superpure inorganic materials is discussed. Subjects presented are: (1) thermodynamic evaluation of the effectiveness of purification by chemical transport processes, (2) methods of accomplishing gas phase transport, and (3) numerical models of chemical transport process. P.N.F.

N71-28301# Joint Publications Research Services, Washington, D.C.

THERMAL DIFFUSION

In its Methods of Producing Superpure Inorg. Substances 1 Jun. 1971 p 419-425 refs (See N71-28290 16-06)

Avail: NTIS HC$6.00/MF$0.95

The principles and applications of thermal diffusion processes for the separation of materials are discussed. Thermal diffusion disrupts three dimensional heterogeneity in such a way that one form of molecules is diverted to a region of higher temperature and the other in the opposite direction. Equipment used in thermal diffusion processes is described. Mathematical models of the thermal diffusion process are presented. P.N.F.

N71-28302# Joint Publications Research Service, Washington, D.C.

CHEMICO-PHYSICAL METHODS OF PURIFICATION OF INORGANIC SUBSTANCES

In its Methods of Producing Superpure Inorg. Substances 1 Jun. 1971 p 426-442 refs (See N71-28290 16-06)

Avail: NTIS HC$6.00/MF$0.95

The removal of microimpurities from substances by chemico-physical methods is discussed. The methods are based on a difference in the equilibrium constants or rate constants of reactions between a chemical reagent and macro- and micro-components of a system. Chemical reactions for selective oxidation and reduction of microimpurities are described. Mathematical models of the reactions are presented. P.N.F.

N71-28303# Joint Publications Research Service, Washington, D.C.

STORAGE OF SUPERPURE SUBSTANCES

In its Methods of Producing Superpure Inorg. Substances 1 Jun. 1971 p 443-455 refs (See N71-28290 16-06)

Avail: NTIS HC$6.00/MF$0.95

The design and characteristics of containers for storage and shipment of superpure materials are presented. Various types of packaging for superpure substances are illustrated. Quality control of packaging purity and cleansing procedures prior to opening containers are discussed. P.N.F.

N71-28314# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THERMOPHYSICAL PROPERTIES OF ALKALI METALS

E. E. Shpilrain et al 14 Jan. 1971 708 p refs Transl. into ENGLISH of the publ. 'Teplofizicheskiye Svoystva Shchelochnykh

Metallov' Moscow, Izd. Standartov, 1970 p 1-488
(AD-721947; FTD-MT-24-120-70) Avail: NTIS HC $9.00/MF $0.95 CSCL 7/4

The monograph is dedicated to the complex investigation of thermophysical properties of alkali metals - lithium, sodium, potassium, rubidium and cesium - in condensed and vaporous phases in a wide interval of parameters of state. The basis of operation is formed by detailed analysis of existing experimental and theoretical data about corresponding properties. The most reliable results are sampled and coordinated. For metals in the condensed phase, the temperature relationship of density, enthalpy, viscosity, thermal conductivity, electrical conductivity, surface tension was investigated. In vapor phase, the relationship of vapor pressure to temperature, thermodynamic properties of dry saturated and superheated vapors, and also transfer properties - viscosity and thermal conductivity was investigated. There are tables, illustrations and a bibliography of 357 titles. Author (GRA)

N71-28341# Pennsylvania Univ., Philadelphia. Electrochemistry Lab.
THE INVESTIGATION OF THE MECHANISM OF FORMATION OF PASSIVE LAYERS ON METALS BY MEANS OF ELLIPSOMETRY Annual Report, 1 Mar. 1970-28 Feb. 1971
Woon-Kie Paik and John O'M. Bockris 1 Mar. 1971 17 p refs
(Contract N00014-67-A-0216-0016)
(AD-721719; AR-1) Avail: NTIS CSCL 7/4

Electrochemically induced passivity of cobalt in contact with aqueous solution of pH 8.3 was observed by electrochemical and optical measurements. Dissolution rate of cobalt was reduced by a factor of about ten by passivation at the potentials between -0.3 and +0.6 volts vs. SCE. A new method of extended ellipsometry, in which reflectivity as well as the polarization states of reflected light were measured and used for the calculations of thickness and optical constants of a thin film, was developed. The passivating film formed at -0.08V vs. SCE was found, by application of the extended ellipsometry, to have thickness of 12 A and optical constants of 3.0-i0.25. Author (GRA)

N71-28353# Pennsylvania Univ., Philadelphia. Electrochemistry Lab.
STRUCTURE OF THE DOUBLE LAYER AT SOLID SOLUTION INTERFACES Annual Report, 1 Jan.-31 Dec. 1970
Yoshiharu Matsuda, Alexander Damjanovic, and John O'M. Bockris 1 Jan. 1971 24 p refs
(Contract N00014-67-A-0216)
(AD-721718; AR-1) Avail: NTIS CSCL 7/4

The structure of the electric double layer as solid metal solution interfaces has been studied. A new technique, based on electrocapillary thermodynamics, has been developed to determine surface excess charge at a given electrode for various electrode potentials and solution concentrations. The technique makes use of rapid immersion of dry electrodes into solution and following the current required to establish the interfacial region. With this technique, surface excess Cl(-) ions has been determined at gold electrodes. Author (GRA)

N71-28354# Army Missile Command, Redstone Arsenal, Ala. Propulsion Directorate.
SYNTHESIS OF 12 HYDROXYSTEARIC ACID ESTERS OF TRIS [1-(2-METHYL) AZIRIDINYL] PHOSPHINE OXIDE
Donald A. Morgan 16 Feb. 1971 23 p refs
(AD-721655; RK-TR-71-5) Avail: NTIS CSCL 7/3

The report contains the results of an investigation on the synthesis of esters of 12-hydroxystearic acid and tris (1-(2-methyl) aziridinyl) phosphine oxide with low content of free 12-hydroxystearic acid. Favorable conditions of synthesis were found to be not over 100C, not less than 3 hours reaction time, presence of some water, and absence of heavy metals. Products were tentatively identified as the mono- and di-acid esters of the monomer, dimer, and trimer. Author (GRA)

N71-28357# RAI Research Corp., Hauppauge, N.Y.
DEVELOPMENT OF MACROMOLECULAR SUPERCONDUCTORS Final Report, Dec. 1968-Dec. 1969
Richard H. Wiley and Joseph Lee 24 Apr. 1970 141 p refs
(Contract DAAK02-69-C-0222)
(AD-721916; RAI-420) Avail: NTIS CSCL 7/3

Polymerization of diphenyldiacetylene, diphenylacetylene and phenylacetylene was studied. For diphenyldiacetylene and phenylacetylene both Ziegler - Natta type catalyst and thermal polymerizations are successful. For diphenylacetylene, a cyclic trimer was obtained with catalyst but no thermal polymerization was observed. B-ethynylnaphthalene was synthesized and polymerized. Their properties are described. Theoretical calculations of the electron-electron interaction between the side chain and the spine were performed, based on Littles model. The effect of replacing the cyanine side chain with various groups have been evaluated and naphthalene and azulene yield an acceptable value. Author (GRA)

N71-28437# California Univ., Los Angeles. Dept. of Chemistry.
AFOSR PROGRAM IN SPACE CHEMISTRY AT UCLA. THE CHEMISTRY OF MATERIALS UNDER EXTREME CONDITIONS INCLUDING IONIZING RADIATION, HIGH VACUUM, HIGH PRESSURE, AND HIGH TEMPERATURE Final Report, 15 Jan. 1967-30 Nov. 1970
W. F. Libby Mar. 1971 75 p refs
(Grant AF-AFOSR-1255-67)
(AD-720289; AFOSR-71-0594TR) Avail: NTIS CSCL 7/4

The report covers a broad spectrum of work in such areas as the high pressure synthesis of metals made of the Group II, III, IV and V chemical elements, the synthesis of polymers by the ionizing photolysis of hydrocarbons, the interactions due to d electrons and the unusual valencies of metal atoms in compounds with general formulas such as (M6X8)(+4), (M6X12)(+2), and (M3X12)(-3), the chemistry of planetary atmospheres, the growth of diamond crystals, the energy transport in large conjugated molecules such as cobalt and iron phthalocyanine, and the catalytic action of such compounds as SrTi03 and LaCo03. Author (GRA)

N71-28620* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
EPOXY-AZIRIDINE POLYMER PRODUCT Patent
Sarkis H. Kalfayan and Barbara A. Campbell, inventors (to NASA) Issued 27 Apr. 1971 3 p Filed 27 Sep. 1968 Cl. 260-47; Int. Cl. C08g30/14 Sponsored by NASA
(NASA-Case-NPO-10701; US-Patent-3,576,786; US-Patent-Appl-SN-763355) Avail: US Patent Office CSCL 07D

A polymeric product resulting from the reaction of polyfunctional epoxy resins with polyfunctional aziridine compounds, is discussed. The resultant products have excellent physical properties, together with high temperature stability so that they can be used to obtain improved results in many applications where epoxy resins are currently found. Additionally, the infusible polymeric product results from a rapid low temperature cure which is similar to that obtained with amine catalysts used for epoxy resins. Official Gazette of the U.S. Patent Office

N71-28635*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
ANALYTICAL DEVICE FOR GASES Patent Application
Charles H. Leigh, inventor (to NASA) 12 p Filed 28 Jan. 1969
(NASA-Case-ERC-10021; US-Patent-Appl-SN-794531) Avail: NTIS CSCL 07D

An analyzing device is described having a test cell filled with fluid through which a polarized laser beam is directed. Certain molecular constituents of the medium are detected by measuring

the intensity of light transmitted through the cell while either an electrostatic or electromagnetic field is applied. The intensity of transmitted laser light is influenced by field produced orientation of the detected molecular constituents. NASA

N71-28742# Boeing Scientific Research Labs., Seattle, Wash.
MOTION IN POLY (4,4-OXYDISPHENYLENE) PYROMELLITIMIDE
Wolfgang Wrasidlo Mar. 1971 23 p refs
(AD-721934; D1-82-1061) Avail: NTIS CSCL 7/4

The thermal behavior of amorphous poly-4,4-oxydiphenylenepyromellitimide Du Ponts H- Film was studied by means of dynamic mechanical, dielectric and calorimetric methods over a temperature range from -100 to 500 C. The heat capacity is a smooth monotonic function of temperature indicating the lack of any motion leading to transitions in this polymer. On the other hand there are two distinct relaxation regions with maxima at 278 and 400 C (f(max) = 110 Hz). Activation energies obtained from the temperature dependence of the frequency of maximum dielectric absorptions were 25 and 43 + or - 3 Kcal/mole for the two absorptions respectively. These results are interpreted from a mechanistic point of view. Author (GRA)

N71-28764# Geological Survey, Denver, Colo.
METHOD TO DESCRIBE THE FLOW OF RADIOACTIVE IONS IN GROUND WATER Final Report, 1 Dec. 1966 -30 Jun. 1968
David B. Grove Dec. 1970 41 p refs Sponsored by AEC Prepared for Sandia Corp., Albuquerque, N.Mex.
(SC-CR-70-6139) Avail: NTIS

An equation based on instantaneous ion exchange and on a linear adsorption isotherm predicts ionic concentrations in the ground water system as a function of time and position. This equation accounts for radioactive decay, ion exchange, and longitudinal hydraulic dispersion. Critical constants necessary for solution include ground water velocity, ion exchange distribution coefficient, exchange ratio, and dispersion coefficient. The need for simplicity dictates the use of an equilibrium concept rather than a rate process to describe the ion exchange reaction in the predictive equation. Author (NSA)

N71-28807* Battelle Memorial Inst., Columbus, Ohio.
PROCESS FOR PREPARATION OF HIGH-MOLECULAR-WEIGHT POLYARYLOXYSILANES Patent
William R. Dunnavant, inventor (to NASA) Issued 20 Feb. 1968 2 p Filed 17 Feb. 1967 Cl. 260-47 Sponsored by NASA
(NASA-Case-XMF-08674; US-Patent-3,370,039;
US-Patent-Appl-SN-617775) Avail: US Patent Office CSCL 07D

A process for increasing the molecular weight of polyaryloxysilane polymers and upgrading their properties so that they can be fabricated into useful articles is discussed. Polyaryloxysilanes prepared by the reaction of a dianilinosilane and an organic diol, for example, dianilinodiphenylsilane and p,p'-biphenol, are mixed with a small amount of the dianilinosilane monomer and the mixture is heated under vacuum or inert gas sweep for at least thirty minutes at 200 to 300 C. This treatment converts the polymer from a brittle, low molecular weight form to a nonbrittle, high molecular weight material suitable for further processing.
Official Gazette of the U.S. Patent Office

N71-28808* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TRIALKYL-DIHALOTANTALUM AND NIOBIUM COMPOUNDS Patent
Gordon L. Juvinall, inventor (to NASA) Issued 6 Aug. 1968 2 p Filed 9 Jul. 1965 Cl. 260-429 Sponsored by NASA
(NASA-Case-XNP-04023; US-Patent-3,396,184;
US-Patent-Appl-SN-470902) Avail: US Patent Office CSCL 07D

Organometallic compounds of the formula R3MX2 are disclosed. R3 is an alkyl group containing from one to four carbon atoms, M is tantalum or niobium, and X is halogen. The compounds are prepared by reacting at low temperature under vacuum in an inert organic solvent, dialkyl zinc compound with a tantalum or niobium pentahalide and recovering the desired compound. These volatile compounds can be pyrolyzed to deposit a film of metal on a variety of substrates.
Official Gazette of the U.S. Patent Office

N71-28831 National Lending Library for Science and Technology, Boston Spa (England).
ASSESSMENT BY THE CRYOSCOPIC METHOD OF THE MOLECULAR WEIGHT OF THE ANOMALOUS COMPONENT BY MODIFIED WATER [OTSENKA MOLEKULYARNOGO VESA ANOMALNOGO KOMPONENTA MODIFITSIROVANNOI VODY KRIOSKOPICHESKIM METODOM]
B. V. Deryagin et al 18 Sep. 1970 7 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 189, no. 6, 1969 p 1292 - 1295
(NLL-Lib-Comm-1551-(5196); LT-1290) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The molecular weight of the anomalous component of water is discussed in terms of the lower volatility, and higher viscosity resulting in the vitrification of concentrated modified water when the temperature is lowered. Equations for the liquid-solid phase dissociation below 0 C are given, and the experimental data are compared to the computed results. It is concluded that the molecular weight of the anomalous component far exceeds the weight of ordinary water. F.O.S.

N71-28961*# National Aeronautics and Space Administration, Washington, D.C.
THE DISSOCIATION OF CERTAIN OXIDES AND PEROXIDES. 3: DISSOCIATION OF LITHIUM AND POTASSIUM PEROXIDE [DYSOCJACJA PEWNYCH TLENKOW I NADTLENKOW. 3: DYSOCJACJA NADTLENKOW LITU I POTASV]
Mieczyslaw Blumenthal Jun. 1971 17 p refs Transl. into ENGLISH from Roczniki Chem. (Poland), v. 12, 1932 p 119 134
(NASA-TT-F-13629) Avail: NTIS CSCL 07D

The dissociation of Li2O2 was investigated and calculated according to the Nernst equation. Potassium peroxides were produced by the methods of Joannis and Rengade, and dissociation stresses as well as temperatures were investigated and calculated. Author

N71-28962*# Scientific Translation Service, Santa Barbara, Calif.
STUDIES ON SUGAR PRODUCTION BY FORMALDEHYDE CONDENSATION. PART 1: CONDENSATION IN THE PRESENCE OF CALCIUM HYDROXIDE [FORUMARDEHIDO NO SHUKUGO NI YORU TO-SEISAN NI KAN-SURU KENKYO DAI-IPPO. SUISANKA KARUSHIUMU NI YORU SHUKUGO]
Tadashi Nakai et al Washington NASA Jun. 1971 15 p refs Transl. into ENGLISH from J. Agr. Chem. Soc. Japan (Tokyo), v. 43, no. 5, 1969 p 300 -305
(Contract NASw-2035)
(NASA-TT-F-13709) Avail: NTIS CSCL 07D

The production of sugar by formaldehyde condensation in the presence of calcium hydroxide is discussed. The condensation was carried out at 50 C in most cases. As the formaldehyde concentration was raised up to the limit of 4.05% (w/v), the time required to complete the reaction was reduced. Yields of the total sugar per 1 gram formaldehyde were practically constant within the range of formaldehyde concentration of 0.81 to 4.05% (w/v). With other concentrations, the yield was low. The addition of minute quantities of monosaccharides to the reaction mixture increased the yield of total sugar and reduced the time required to complete the reaction. In 24 experiments carried out up to this time, no significant amount of fermentable sugar was produced. Author

N71-28013 National Lending Library for Science and Technology, Boston Spa (England).
INVESTIGATION OF ADSORPTION OF ALLYL ALCOHOL ON MONTMORILLONITE BY INFRARED SPECTROSCOPY [DOSLIDZHENNYA ADSORBTSIYI ALILOVOGO SPIRTU NA MONTMORYLONITI METODOM INFRACHERVONOYI SPEKTROSKOPIYI]
F. D. Ovcharenko et al Dec. 1970 7 p refs Transl. into ENGLISH from Dopovidi Akad. Nauk Ukr. SSSR Ser. (Kiev), v. 29, no. 7, 1967 p 631-634
(NLL-RTS-6208) Avail: Natl. Lending Library, Boston Spa, Engl.: £0.50; 2 NLL photocopy coupons

The adsorption of allyl alcohol vapor onto Li, Na, Cs, and Fe(3+) specimens of Pizhev montmorillonite was investigated. Infrared spectra are given of the montmorillonites in the zone of O-H and C=C stretching vibrations. It is suggested that the coordination of allyl alcohol molecules is effected by the oxygen atoms of the hydroxyl groups, leading to a shift of the O-H valent oscillation towards lower frequencies. The O-H frequency band shift to a much higher frequency indicates that secondary alcohol molecules affect cations slightly and interact through hydrogen bonds either with surface oxygen or with neighboring molecules. N.E.N.

N71-29055 National Lending Library for Science and Technology, Boston Spa (England).
INFRARED STUDY OF THE CROSSLINKING REACTIONS OF LATEX THERMOSETTING POLYMERS [IZUCHENIE METODOM IR-SPEKTROSKOPII REAKTAII SHIVANIYA LATEKSNYKH TERMOREAKTIVNYKH POLIMEROV]
I. S. Pinskaya et al Dec. 1970 9 p refs Transl. into ENGLISH from Lakokrasochnye Materialy i ikh Primenenie (Leningrad), v. 5, 1969 p 7-10
(NLL-RTS-6218) Avail: Natl. Lending Library, Boston Spa, Engl.: £0.70; 2 photocopy coupons

A twin-beam infrared spectrophotometer was used to analyze the cross-linking reactions of the latex copolymers in relation to molecular weight and the number of methylolamide groups, and to trace the reactions of the methylol and amide groups of the latex copolymer with the epoxy groups of the cross-linking agent. The infrared spectra of films approximately 20 microns thick were recorded in both the low- and high-frequency regions. In films of different molecular weights, the different relative reductions in the intensity of bands in the 3200 to 3400 cm/1 and 1520 to 1530 cm/1 regions show that the degree of cross-linking is higher for films prepared from polymers of higher molecular weight. In the lower molecular weight product, a smaller number of amide atoms of hydrogen take part in the cross-linking reactions. It was also found that heat treatment results in the disappearance of the band related to epoxy ring vibrations. M.G.J.

N71-29084 National Lending Library for Science and Technology, Boston Spa (England).
SOME FEATURES OF EMULSION POLYMERIZATION WITH POLYMER EMULSIONS [NEKOTORYE OSOBENNOSTI EMULSIONNOI POLIMERIZATSII S POLIMERNYMI EMULGATORAMI]
A. Ya. Chernikhov et al Nov. 1970 9 p refs Transl. into ENGLISH from Kinet. and Mech. of Polyreactions, IUPAC Intern. Symp. Macro. Chem., v. 3, 1969 p 391-395
(NLL-RTS-6161) Avail: Natl. Lending Library, Boston Spa, Engl.: 14s; 2 NLL photocopy coupons

The effects of the changes brought about in the structure of the adsorbing layers by the transition from the usual low-molecular emulsifier to the high-molecular emulsifier are examined. Polyemulsifiers were synthesized on a base of isotactic poly-2-vinyl pyridine with a molecular weight of about 300,000 by combining them with nonyl bromide with the subsequent replacement of some of the Br(-) ions by OH(-) ions. The tangled-ball structure, viscosity, and effects of the number of ion-forming groups are described. N.E.N.

N71-29085 National Lending Library for Science and Technology, Boston Spa (England).
FEATURES OF THE POLYMERIZATIONS OF UNSATURATED COMPOUNDS IN AQUEOUS EMULSIONS WHEN INITIATION IS LOCALIZED IN BOUNDARY LAYERS [OSOBENNOSTI POLIMERIZATSII NEPREDELNYKH SOEDINENII V VODNYKA EMULSIYAKH PRI LOKALIZATSII PROTSESSA INITIIROVANIYA V POGRANICHNYKH SLOYAKH]
A. I. Yurzhenko et al Nov. 1970 9 p refs Transl. into English from Kinet. and Mech. of Polyreactions, IUPAC Intern. Symp. Macro. Chem., v. 3, 1969 p 399-402
(NLL-RTS-6162) Avail: Natl. Lending Library, Boston Spa, Engl.: 14s; 2 NLL photocopy coupons

Characteristics of the emulsion polymerization process when the initiation and growth of macromolecule chains is concentrated in boundary layers are discussed. Emulsifiers capable of activating the decomposition of peroxides and colloidal surface-active initiators were used. The polymerization process varies little with the colloidal properties of the detergents, and polymerization initiation was found to increase about 1000 times in passing from weakly acid to weakly alkaline solutions. Non-ion forming detergents were also investigated for radiacal polymerization. Thermomechanical properties are described, and the most interesting feature is identified as the production of stereo-regular polymers on solid sorbents. N.E.N.

N71-29169 National Lending Library for Science and Technology, Boston Spa (England).
ELECTROLYTIC DEPOSITION AND CODEPOSITION OF PARTICLES DISPERSED IN ELECTROLYTE SOLUTIONS
R. S. Saifullin 3 Nov. 1970 12 p refs Transl. into ENGLISH from Tr. Kazansk. Khim. Tekhnol. Inst. (Kazan), no. 30, 253-258 In ENGLISH and RUSSIAN
(NLL-LTI-746-622-(9022.401); LTI-734-5484) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Conditions favoring the deposition and codeposition of different powders during electrolysis and the effect of codeposition on the properties of electrodeposits are discussed. Results of experiments conducted on precipitation of powders and coprecipitation of powders from plating baths are presented. Experimental conclusions indicated: (1) From aqueous solutions of electrolytes, and also from non-aqueous formic acid, only metals, disposed in emf series, are electrolytically deposited from a dispersed state. (2) With identical expenditure of current, the weight of the metals deposited from a powder state can be higher than for the same metals discharge from the ion state. (3) Qualitative electrodeposits, obtained from electrolytes containing dispersed particles, are usually characterized by an increased hardness and better anti-corrosion properties than usual deposits. A.L.

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N71-28055# Grumman Aerospace Corp., Bethpage, N.Y. System Sciences Section.
EMPIRICAL OPTIMIZATION OF ANTENNA ARRAYS
S. Blank Jun. 1971 67 p refs
(RE-409) Avail: NTIS

A technique developed to optimize the performance of antenna arrays under realistic, on the vehicle conditions, is described. This technique permits free choice of optimality criteria and design

parameters and is applicable to both planar and nonplanar arrays with geometric constraints. The investigation resulted from an initial study of the antenna array problem under the assumption of idealized free-space conditions. An experimental-computational approach to the solution of this problem was formulated in which powerful n-dimensional optimum search methods are applied to experimental data obtained from carefully scaled models of the vehicle and antenna array configuration. The optimization algorithm provides a new design for the antenna array that is then used in the scale model, and the process develops in an iterative fashion. The necessary laboratory setup and data processing techniques used to test the feasibility of this approach are discussed. Experimental results showing encouraging improvements have been obtained on an array of eight elements both with and without an aircraft model. These results indicate that the algorithmic procedure is both stable and convergent. Author

N71-28162*# Hughes Aircraft Co., Culver City, Calif. Aerospace Group.

STUDY AND DEVELOPMENT OF A MATHEMATICAL ANALYSIS FOR THE PERFORMANCE ASSESSMENT OF SPACE COMMUNICATION SYSTEM PARAMETERS Final Report

L. S. Stokes, K. L. Brinkman, W. K. Pratt, and J. W. Weber May 1969 311 p refs

(Contract NAS12-566)

(NASA-CR-119003; P68-267) Avail: NTIS CSCL 17B

The executive program, COPTRAN, refining procedures for the CDC 6400 computer and updating of the user's manual are presented for the performance assessment of space communications system parameters. The updating includes the incorporation of a worth calculation and a two position implementation of pulse position modulation for optical modulation and detection. The COPTRAN structure, program entry, use, examples, multiple case processing, error messages, data decks, automatic data selection, and nominal system burdens are covered. The analysis of discrete point input is also reported. A description of COPTRAN as a technology tool; planetary data and distance conversion factors; atmospheric optical and radio propagation loss data; and the slant range to a low altitude satellite are appended. J.M.

N71-28174# Joint Publications Research Service, Washington, D.C.

SOME EFFECTS DURING THE PASSAGE OF RADIO WAVES THROUGH THE REGION OF AN EXPLOSION

V. A. Velmin et al 10 Jun. 1971 19 p refs Transl. into ENGLISH from Zh. Prikl. Mekhan. i Tekhn. Fiz. (Moscow), no. 2, 1971 p 136 - 139

(JPRS-53334) Avail: NTIS

Nonstationary effects observed in radio wave propagation through an explosion are described and interpreted to explain the explosion processes. Explosives in charges of 10 to 52 g were placed between centered horn lens antennas. The wavelength of the radiated energy was 8 mm, and the radiation pattern was 16 deg in width. The signal from the receiving antenna was recorded on an oscillograph for a 125 microsecond interval. A simplified approach was found sufficient to explain the time characteristics. Expressions are developed for the oscillation period, the radius of effective explosion boundary, and the relation between them. The relation between radius and time is determined by the ratio of the explosion energy to the undisturbed gas density. N.E.N.

N71-28234# Shell Exploration and Production Lab., Rijswijk (Netherlands).

MINIMUM PHASE IN SAMPLED-SIGNAL THEORY

Augustinus Johannes Berkhout (Ph.D. Thesis - Tech. Hogeschool Delft) Feb. 1970 253 p refs

Avail: NTIS

The investigated sampled signals may be complex and of infinite duration. Using the least-squares inverse filtering theory, a minimum-phase criterion is derived for signals of finite and infinite duration. The minimum-complexity signal is introduced, and the properties of the minimum-phase signal are translated into properties of the minimum-complexity signal. ESRO

N71-28276# Stanford Univ., Calif. Electronics Labs.

LINE-OF-SIGHT PROPAGATION OF MILLIMETER RADIO WAVES Final Report, 1 Dec. 1967 - 30 Nov. 1970

Alan T. Waterman, Jr., Robert W. Lee, and Jeffrey C. Harp Dec. 1970 29 p refs

(Contract F19628-68-C-0055)

(AD-720276; SU-SEL-70-085; AFCRL-71-0020) Avail: NTIS CSCL 20/14

The effects of atmospheric irregularities on line-of-sight propagation are studied both experimentally and theoretically. The experimental measurements utilize a pair of 35 GHz transmitting antennas, time shared through a rapid switching arrangement, and an array of receiving antennas at each of which amplitude and relative phase of the arriving wave are measured separately. This configuration is coordinated with 11 GHz transmissions propagated over the same 28 km path. The entire set-up is highly versatile and permits a variety of different types of propagation measurements to be made in near simultaneity. Author (GRA)

N71-28335# Boeing Co., Renton, Wash. Airplane Div.

ORTHOGONAL DETECTION OF RADAR TARGETS IN RAIN AT Ku BAND

G. L. Jonsen and R. J. Priedland 1971 13 p

(AD-721627; D6-16136) Avail: NTIS CSCL 17/9

A comparison was made of the co-polarized and cross-polarized radar return from terrain and various waterborne and airborne targets under the rain conditions noted. Clutter due to weather is greatly reduced in the cross-polarized channel, and the detection of targets in that channel is greatly enhanced. Measurements made indicate clutter return in the cross-channel is down approximately 20 db from that in the co-channel. Changing the transmitted polarization from horizontal to vertical makes no apparent difference in the effect. Author (GRA)

N71-28336# Naval Postgraduate School, Monterey, Calif.

COMMUNICATION RESOURCES ALLOCATION: A GAME OF STRATEGY

Raymond Charles Patrick Lafser (M.S. Thesis) Mar. 1971 45 p refs

(AD-721548) Avail: NTIS CSCL 17/2

The thesis looks at optimally allocating communication resources from a game theory point of view. Three basic models are presented and then expanded upon. A prime objective is to briefly review representative examples of work previously done in the attack-defense area showing how it can be applied to the optimal allocation problem for communication resources and indicate the possible direction for future research. Author (GRA)

N71-28337# Air Force Cambridge Research Labs., Bedford, Mass.

IONOSPHERIC AND TROPOSPHERIC LIMITATIONS TO RADAR ACCURACY

Donald L. Evans, comp. 5 Feb. 1971 111 p refs *Its* Air Force Surv. in Geophys, No. 231

(AD-722046; AFCRL-71-0169) Avail: NTIS CSCL 17/9

The report discusses the contribution of the troposphere and the ionosphere and their irregularities to the residual errors of specific radar systems located in midlatitude and polar regions. Author (GRA)

N71-28412# Institute for Telecommunication Sciences, Boulder, Colo. Office of Telecommunications.

ON CALCULATIONS OF THE MODAL PARAMETERS OF AN IDEALIZED EARTH-CRUST WAVEGUIDE

Kenneth P. Spies and James R. Wait 17 Mar. 1971 63 p refs
(Order NAonr-15-71)
(AD-721371; TR-1) Avail: NTIS CSCL 20/14

Calculations for the mode characteristics for the earth-crust waveguide are presented. The formulation allows for any depth-conductivity profile, but the specific results are only for a homogeneous sub-surface waveguide region with a finitely conducting lower layer and a perfectly conducting upper layer. Attenuation rates of the order of 1 dB/km are possible for operating frequencies of 20 kHz or lower if the crystalline rock in the waveguide has conductivities less than 0.000001 mhos per meter. The tabular data include results for the phase velocity and excitation factors of the dominant modes. Author (GRA)

N71-28418# Army Electronics Command, Fort Monmouth, N.J.
INTELLIGIBILITY TESTING OF THE CONTINUOUS VARIABLE SLOPE DELTA (CVSD) CODER-DECODER (CODEC)
Elis D. Ecom Feb. 1971 33 p
(AD-721586; ECOM-3393) Avail: NTIS CSCL 17/2

The report contains the results of a series of intelligibility tests performed on a Continous Variable Slope Delta (CVSD) coder-decoder (codec) subjected to various operating conditions. The test used was the Consonant Recotion Acquisition Technical Area, Communications/ADP Laboratory. The CVSD codec was operated at 19.2 kb/s and 38.4 kb/s and its performance was evaluated for digital error rates of 0%, 1%, and 10%, and with the codec connected in tandem with other CVSD codecs, a channel vocoder and a Pulse Code Modulation (PCM) system. Author (GRA)

N71-28427*# Auburn Univ., Ala. Satellite Communications Lab.
TELEVISION BROADCAST RELAY SYSTEM
E. R. Graf 30 Nov. 1970 61 p refs
(Contract NAS8-24818)
(NASA-CR-119851; TR-2) Avail: NTIS CSCL 17B

A method of handling data pertaining to the design of a satellite television broadcast system is discussed in depth. Sample data is analyzed and plotted by computer techniques. Author

N71-28428*# Auburn Univ., Ala. Satellite Communications Lab.
RECEIVER ANTENNAS FOR APPLICATION IN A TELEVISION BROADCAST RELAY SYSTEM
E. R. Graf 30 Jan. 1970 77 p refs
(Contract NAS8-24818)
(NASA-CR-119852; TR-1) Avail: NTIS CSCL 17B

Various types of antennas are considered for use as UHF home receiving antennas involving a synchronous satellite relay link. A brief survey of present UHF antennas and their application in this system is presented. Spiral and helical antennas are considered and designed for this mode of operation. Author

N71-28429* Motorola, Inc., Scottsdale, Ariz.
PHASE MODULATOR Patent
Kenneth H. Brown and Robert C. Fitting, inventors (to NASA) Issued 18 May 1971 4 p Filed 8 Jan. 1969 Cl. 332-29; Cl. 332-30; Int. Cl. H03c3/12 Sponsored by NASA
(NASA-Case-MSC-13201-1; US-Patent-3,579,147; US-Patent-Appl-SN-789903) Avail: US Patent Office CSCL 17B

A phase modulator is described in which a pair of tuned lines are coupled to a carrier signal source and a load through a quarter-wave coupler. The electrical length of the lines are electrically altered to phase modulate the carrier supplied by the source through the coupler to the load. Varactor diodes and a variable inductance in each of the lines vary the line electrical lengths so that the carrier is linearly modulated. The arrangement is such that the energy reflected form the two lines have phases opposing at the source so that there is no power supplied at the input coupler port while all of the reflected power from the two lines is supplied in phase through the coupler output port to the load. Official Gazette of the U.S. Patent Office

N71-28430* Collins Radio Co., Dallas, Tex.
SIGNAL PATH SERIES STEP BIASED MULTIDEVICE HIGH EFFICIENCY AMPLIFIER Patent
Arthur P. Kubicz, inventor (to NASA) Issued 4 May 1971 7 p Filed 9 Jul. 1968 Cl. 330-124; Cl. 307-296; Cl. 325-185; Cl. 330-40; Cl. 330-200; Int. Cl. H03f3/20; Int. Cl. H03f3/68 Sponsored by NASA
(NASA-Case-GSC-10668-1; US-Patent-3,577,092; US-Patent-Appl-SN-743525) Avail: US Patent Office CSCL 17B

A high-efficiency transformerless amplitude modulation system is described which includes an audio frequency power amplifier having at least two amplifier segments with at least one amplifier device in each. Each segment has a different voltage power supply level and a bias step between adjacent segments. A modulation output, direct dc connection from the audio frequency power amplifier to the system RF power amplifier is also included. Official Gazette of the U.S. Patent Office

N71-28431*# Institute for Telecommunication Sciences, Boulder, Colo.
PHASE AND AMPLITUDE SCINTILLATIONS OF MICROWAVE SIGNALS OVER AN ELEVATED ATMOSPHERIC PATH
M. C. Thompson, Jr., H. B. Janes, L. E. Wood, and Dean Smith [1970] 35 p refs Supported in part by Hawaii Univ. Obs. and ESSA's Mauna Loa Obs.
(NASA Order L-31028)
(NASA-CR-111926) Avail: NTIS CSCL 17B

A technique was proposed to obtain global surveys of atmospheric density profiles by means of a set of co-orbital earth satellites. The method involves measurements of phase delays in microwave signals propagated between pairs of satellites, so that the signal passes through the atmosphere along a part of its path. A basic factor in the success of this technique is the influence of random atmospheric variability (turbulence) on signal-phase and amplitude. These signal properties are also involved in the bandwidth required in the satellite terminal equipment. In addition, other atmospheric propagation effects, notably fading, could have a significant effect on the overall effectiveness of the system. The phenomenon of principal concern in this respect is the very deep fades associated with certain types of refractive index gradients known to occur. Author

N71-28448# Stanford Univ., Calif. Electronics Lab.
OBSERVATIONS OF FINE STRUCTURE IN HF RADIO SIGNALS PROPAGATED AROUND THE WORLD
D. M. Bubenik, A. C. Fraser-Smith, L. E. Sweeney, Jr., and O. G. Villard, Jr. Dec. 1970 13 p refs
(Contracts Nonr-225(64); N00014-70-C-0413; ARPA Order 196; ARPA Order 1656)
(AD-721703; SU-SEL-70-077; SU-TR-164) Avail: NTIS CSCL 20/14

A fine structure has been observed in oblique ionograms taken over round-the-world paths. This structure appears as roughly horizontal striations on the time-delay vs frequency plots of the received signals, and several examples of these ionograms, taken during the course of a year, are shown. The form of the structure varies with the time of day; however, a degree of overall constancy can be found in records taken six months apart. It is thought that the fine structure represents a resolution of the paths taken by the RTW signal. Author (GRA)

N71-28581 Washington Univ., Seattle.
ON UNBIASEDNESS AND INVARIANCE IN SIGNAL DETECTION THEORY
Louis L. Scharf, Jr. (Ph.D. Thesis) 1969 153 p
Avail: Univ. Microfilms Order No. 70-14787

The statistical concepts of unbiasedness and invariance are investigated as keys to deriving signal detectors with desirable performance characteristics. One of the central problems considered

is that of detecting a known form signal of unknown energy in Gaussian noise of unknown level. It is shown in this dissertation that there exists a test of H sub 0 versus H sub 1 that is both UMP unbiased and UMP invariant. It is found that the detection problem is independent of knowledge about the noise level, since the test is able to make a perfect estimate of delta sub 2. This conclusion is reconciled by noting that the desired test (signal detector) can never be physically realized. It is shown that any physically realizable version of the test is t-distributed. This permits evaluation of realizable test performance. The stability of the test is investigated for errors in the assumed form for the covariance function, rho(t,u), and sufficient conditions are derived to ensure stable performance
Dissert. Abstr.

N71-28585 Wisconsin Univ., Madison.
A DIGITAL COMPUTER SIMULATION AND ANALYSIS OF A TROPOSPHERIC SCATTERING CHANNEL MODEL UTILIZING REALISTIC METEOROLOGICAL STRUCTURE AND PARAMETERS
Ronald David Pittle (Ph.D. Thesis) 1969 137 p
Avail: Univ. Microfilms Order No. 70-3664)

An attempt was made to simulate the envelope and phase recordings received from a sine wave transmitted over a transhorizon, tropospheric scatter link with a digital computer. The simulation model postulates that the scattering of the transmitted radio waves results from a thin layer of discrete; macroscopic scatterers which is drifting horozontally through the common volume. A ray-path geometry was developed to determine the phase and Doppler shift associated with each scattered signal in terms of its position within the link space. Applications of classical turbulence theory were used to predict the relative voltage amplitude of the scattered signal in terms of the scatterer's position. Both isotropic and anisotropic models were employed. Due to the dimensions of the radio link only the crosspath horizontal motion of the scatterers was considered. The Doppler spectrum centroid and the average phase rates of both the radio and simulated data are compared and discussed. Dissert. Abstr.

N71-28595# Joint Publications Research Service, Washington, D.C.
CIRCULAR SCANNING CATHODE RAY TUBE CODER
V. B. Sakhov et al 10 Jun. 1971 6 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Priborostr. (Leningrad), no. 9, Sep. 1967 p 71-75
(JPRS-53333) Avail: NTIS

A device is described for coding a broadband signal. In order to secure high-speed response, a special cathode-ray tube was used in the coding which was outfitted with a circular scanner which excluded the return trace of the beam, thus making it possible to employ scanning generators with high conversion frequencies. The device makes it possible to secure a time-parallel code through use of electrically insulated sectorial targets within the cathode-ray tube. The choice of a scanning frequency higher than the conversion frequency and averaging of the signal from tube load frequencies by means of narrowband amplifiers, are discussed. Author

N71-28655# Emmanuel Coll., Boston, Mass. Oriental Science Research Library.
AN EASY METHOD OF RECEIVING PICTURE SIGNALS FROM SATELLITES
Hajimu Sakagami, Tadahiko Yoshida, Yasuharu Arima, and Yoshiaki Nakata 19 Feb. 1971 32 p refs Transl. into ENGLISH from Denpa Kenkyujo Kiho (Japan), v. 14, no. 72, 1968 p 357-367
(Contract F19628-68-C-0251)
(AD-722045; EMM-256; Rept-70-3; AFCRL-71-0061; AFCRL-TRANS-88) Avail: NTIS CSCL 17/2

Experiments were carried out to obtain an easy method of receiving picture signals from ESSA4 NIMBUS, and ATS satellites and to determine the quality of apparatus required for the purpose. The experiments involved measurement of the electric field intensity from the satellites and examination of the contrast, resolution, and fineness of the reproduced pictures that were sent back to the earth by the satellites automatic picture transmission system whose signals were carried at a frequency of 136 MHz and modulated to AM-FM by video signals. The signals, received by simple antennas such as the doublet, turnstile or helical antenna and through an FM receiver, were reproduced by a facsimile machine. It was necessary to insert a modulation-increasing circuit between the FM receiver and the facsimile reproducer when the modulation index of the video signals was as low as the NIMBUS signals. Faraday fading, scintillation fading, the environmental effect on the antennas interruption of interference, and external noises were also considered. Author (GRA)

N71-28656# General Electric Co., Utica, N.Y. Aerospace Electronic Systems.
L-BAND TELEMETRY PROGRAM Final Engineering Report, 2 Mar.-31 Dec. 1970
E. Joslin Jan. 1971 39 p
(Contract N00019-69-C-0399)
(AD-721389) Avail: NTIS CSCL 9/6

The effort involved the development and qualification of an L-Band solid-state FM Transmitter. The Transmitter operates fixed tuned (crystal controlled) within the frequency range 1435-1535 MHz. Author (GRA)

N71-28658# Naval Postgraduate School, Monterey, Calif.
AN INVESTIGATION OF ALTERNATIVE DEPLOYMENT DOCTRINES FOR AN INTEGRATED SENSOR ARRAY IN BASE DEFENSE
Michael Matthew Schneider (M.S. Thesis) Mar. 1971 133 p refs
(AD-721555) Avail: NTIS CSCL 15/3

A mathematical model describing the detection activities of an integrated sensor array containing radars, visual devices and remote sensors is presented. Using the programmed model, infiltration of a base defense area issimulated with a computer and ris of these results is conducted using game and decision theory and a general conclusion concerning an optimal sensor deployment doctrine is derived. The complete computer program is described in the text of the study and is contained as an appendix. Author (GRA)

N71-28750# Princeton Univ., N.J. Dept. of Electrical Engineering.
ON MODELS FOR 1/f NOISE PROCESSES Scientific Interim Report
Kevin C. Daly and John B. Thomas Feb. 1971 12 p refs Presented at the 4th Asilomar Conf. on Circuits and Systems, 18-20 Nov. 1970 Submitted for publication
(Contract DAHC04-69-C-0012; Grants AF-AFOSR-1333-67; NSF GK-1439)
(AD-721450; AFOSR-TR-71-0837) Avail: NTIS CSCL 17/2

A noise phenomenon which is often dominant at low frequencies is comprised of those processes which are called 1/f noise, flicker effect, and sporadic processes. These processes are characterized by a power spectral density which varies as 1/((the absolute value of f) to the power alpha) where theta = or < alpha = or < 2. They have been observed over a wide range of frequencies in such diverse situations as vacuum tube and semiconductor noise, the spectrum of sea waves, and ultra-precise time standards. Some of these processes are not admissable in the usual Wiener-Khinchin theory of random processes. On the other hand, their extensive occurrence suggests that some accomodation must be made for them in the organized theory. It is the purpose of this paper to consider several approaches to the modeling of such 1/f processes. It will be shown that models do exist which satisfactorily explain observed phenomena while retaining adequate connection with the underlying physics of the model. Author (GRA)

N71-28792 Michigan Univ., Ann Arbor.
ESTIMATION OF THE ERROR DENSITY FUNCTION FOR OPTIMUM PULSE MODULATION SYSTEMS
Robert Walter Bayma (Ph.D. Thesis) 1969 130 p
Avail: Univ. Microfilms Order No. 70-14470

A pulse modulation communication channel is characterized by a model in which the observed signal is based on a linear function of a random variable with known a priori probability density function for the known finite energy waveform and on Gaussian noise, independent of the random variable, with known covariance function. Known results are verified analytically for the case of linear (pulse-amplitude) modulation, and a Monte Carlo solution is defined for the general case of nonlinear pulse modulation. The entire density function is estimated rather than some fixed performance measure; and the simulations require samples only from the equivalent noise process. The estimate of the error density function is then used to evaluate the performance of the demodulator for cost functions which depend on the error. A similar expression is also obtained for the mean square error of the minimum mean square error demodulator, and a Monte Carlo simulation is defined for its solution. A particular case of pulse frequency modulation with uniform or Gaussian a priori statistics is analyzed; and a digital Monte Carlo simulation is used to testimate the error density function for the maximum mean square error, minimum mean absolute error, and most probable estimates. A second digital simulation is used to independently estimate the mean square error of the minimum mean square error demodulator.
Dissert. Abstr.

N71-28804 Illinois Univ., Urbana.
THE VISTA SYSTEM FOR COMPRESSION OF TELEVISION SIGNAL BANDWIDTHS
David Charles Rollenhagen (Ph.D. Thesis) 1969 81 p
Avail: Univ. Microfilms Order No. 70-13462

The VISTA (Variable Interlace System for Television Applications) System compresses the bandwidth of television video signals in accordance with the amount of information change between successive television frames. The system automatically determines the information change and selects one out of sixty four possible scanning speeds commensurate with this change. If the television information is constant, a large compression is possible, whereas a sudden change requires the full bandwidth of four MHz for a faithful reproeuction of the television image. Flicker and line drift effects at reduced scan rates are overcome by means of a variable persistence display device and by interlacing the fields in a programmable sequence. A variable scan rate television camera is described and the signal current output of the vidicon as a function of scan rate is analyzed in detail. Also described in detail are the variable rate horizontal ramp generator and the automatic information change detector.
Dissert. Abstr.

N71-28809* Hughes Aircraft Co., Culver City, Calif.
TRIAXIAL ANTENNA Patent
Woodrow W. Black, inventor (to NASA) Issued 17 Dec. 1968 6 p Filed 25 Apr. 1966 Cl. 343-771 Sponsored by NASA (NASA-Case-XGS-02290; US-Patent-3,417,400; US-Patent-Appl-SN-544895) Avail: US Patent Office CSCL 09E

A horizontally polarized antenna arrangement of simplified construction providing improvements in pattern and impedance matching is described. The antenna is designed to provide a toroidal pattern with gain perpendicular to the axis of the antenna. It is horizontally or transversely polarized which minimizes reflections from adjacent antenna elements. The pattern has low side lobes and can be made to approach the maximum gain-band-width configuration.
Official Gazette of the U.S. Patent Office

N71-28822 California Univ., Los Angeles.
NEAR-FIELD DETECTION OF A DIELECTRIC INCLUSION IN A LOSSY HALF-SPACE
David Bressler (Ph.D. Thesis) 1969 225 p
Avail: Univ. Microfilms Order No. 70-14282

The geometry studied consists of a dielectric sphere buried near the surface of a lossy half-space over which is situated a circular waveguide radiator with a ground plane. The theoretical analysis is concerned with determining the reflection coefficient established in the waveguide feed to the radiator (operating monostatically) due to the presence of the sphere. Attention is restricted to the case where the antenna is symmetrically disposed over the sphere. The parameters varied include the operating wavelength, the antenna aperture radius, the height of the antenna above the half-space surface, and the depth, radius, and dielectric constant of the sphere. The solution was effected through the application of the Loretnz reciprocity theorem. The incident electric field was determined by first solving the boundary value problem of the antenna and half-space in cylindrical coordinates.
Dissert. Abstr.

N71-28900* RAND Corp., Santa Monica, Calif.
SATELLITE COMMUNICATION SYSTEM Patent
Glen W. Preston, inventor (to NASA) Issued 11 Jul. 1967 7 p Filed 23 Dec. 1965 Cl. 343-100 Sponsored by NASA (NASA-Case-XNP-02389; US-Patent-3,331,071; US-Patent-Appl-SN-516162) Avail: US Patent Office CSCL 17B

Reported is a radio communications system wherein an orbiting radio relay satellite is equipped with an antenna which is electronically steerable from the ground in response to a variable-frequency signal. This permits the antenna to continuously direct its output beam to a ground station as the satellite moves along its orbit.
Official Gazette of the U.S. Patent Office

N71-28965*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MILLIMETER WAVE ANTENNA SYSTEM Patent Application
William I. Gould, Jr. and Jack Evans, inventors (to NASA) 20 p Filed 2 Dec. 1970 (NASA-Case-GSC-10949-1; US-Patent-Appl-SN-94369) Avail: NTIS CSCL 17B

A description is given of a millimeter wave antenna system particularly adapted for use in outer space, is described. The system includes a conic section reflector with a supporting structure fabricated from a carbon fiber reinforced plastic composite material.
E.H.W.

N71-28979* Keltec Industries, Inc., Alexandria, Va.
UNFURLABLE STRUCTURE INCLUDING COILED STRIPS THRUST LAUNCHED UPON TENSION RELEASE Patent
Lester E. Hoblin, inventor (to NASA) Issued 17 Jan. 1967 3 p Filed 10 Feb. 1964 Cl. 343-823 Sponsored by NASA (NASA-Case-HQN-00937; US-Patent-3,299,431; US-Patent-Appl-SN-343760) Avail: US Patent Office CSCL 09E

An extensible dipole antenna employing a naturally tubular metallic strip element which is deformable into a transverse coil form is discussed. The device is sufficiently resilient to revert to its natural configuration after deployment. The equipment contains a positive action ejection means which is operated by release of a loaded compression spring.
Official Gazette of the U.S. Patent Office

N71-28990* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ANTENNA DESIGN FOR SURFACE WAVE SUPPRESSION Patent
William L. Grantham, inventor (to NASA) Issued 18 May 1971 3 p Filed 23 Dec. 1969 Cl. 343-708; Cl. 343-784; Cl. 343-872; Int. Cl. H01q1/25; Int. Cl. H01q13/00 (NASA-Case-XLA-10772; US-Patent-3,579,242; US-Patent-Appl-SN-887700) Avail: US Patent Office CSCL 09E

Means for suppressing the excitation of electromagnetic surface waves on a dielectric converter antenna are discussed. A hole is cut in the dielectric where it covers the antenna. A plug

of the dielectric material is coated around its rim with a metal and then fitted into the hole such that the metal coating extends the conducting surface of the antenna through the dielectric material. The metallic coating minimizes the possibility of surface wave excitation by confining the waves reflected by the dielectric-air interface to the chamber formed by the coating.
Official Gazette of the U.S. Patent Office

N71-29063*# Stanford Univ., Calif. Center for Radar Astronomy.
BISTATIC RADAR STUDIES OF THE MOON, PART 1 Final Report (Letter), 1 Jun. 1969 - 31 Nov. 1970
G. Lenard Tyler 18 Feb. 1971 8 p refs
(Grant NGR-05-020-348)
(NASA-CR-119033) Avail: NTIS CSCL 17I

Brief descriptions and conclusions are presented for lunar surface slope distributions, polarimetry, relations between surface scattering laws and the bistatic-radar echo spectrum, and polar scattering diagrams based on analyses of bistatic-radar data from Lunar Orbiters 1 and 2 and Explorer 35. Data processing techniques and equipment are discussed including ratios of polarization, numerical methods of computing bistatic-radar spectra from the surface scattering laws, and digital polarimeters. J.M.

N71-29064*# Stanford Univ., Calif. Center for Radar Astronomy.
BISTATIC-RADAR STUDIES OF THE MOON WITH EXPLORER 35. PART 2: METHODS OF DATA REDUCTION AND REDUCED OBSERVATIONS Final Report
G. Leonard Tyler and Richard A. Simpson Oct. 1970 353 p refs
(Grant NGR-05-020-348)
(NASA-CR-119032; SU-SEL-70-068-Pt-2) Avail: NTIS CSCL 17I

The methods used in the reduction of bistatic-radar data from Lunar Orbiters 1 and 2 and Explorer 35 are described. A tabulation of the reflectivity and bandwidth data from Explorer 35 is presented along with the complete polarization spectra for selected portions of the data. Author

N71-29065* National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
QUASI-OPTICAL MICROWAVE COMPONENT Patent
John W. Carson, inventor (to NASA) Issued 13 Apr. 1971 8 p Filed 27 Feb. 1969 Cl. 350-1, Cl. 333-81, 350-286; Int. Cl. G02b13/14; Int. Cl. H01p1/22
(NASA-Case-ERC-10011; US-Patent-3,574,438; US-Patent-Appl-SN-802218) Avail: US Patent Office CSCL 20N

A quasioptical component having a rotatably mounted dielectric body with input and output faces is disclosed. The dielectric body is adapted for connection in an oversize waveguide system such that polarized electromagnetic energy is incident on the input face at the Brewster angle. Rotation of the dielectric body in one direction attenuates the energy transmitted from the output face and rotation in the opposite direction produces a phase shift therein.
Official Gazette of the U.S. Patent Office

N71-29083 National Lending Library for Science and Technology, Boston Spa (England).
A STUDY OF LOCAL SOURCES OF THE SLOWLY-VARYING COMPONENT OF SOLAR RADIO EMISSION IN THE CENTIMETRE WAVELENGTH BAND [ISSLEDOVANIE LOKALNYKH ISTOCHNIKOV MEDLENNO MENYAYUSHCHEISA KOMPONENTY RADIOIZLUCHENIYA SOLNTSA V SANTIMETROVOM DIAPAZONE]
G. B. Gelfreikh et al Dec. 1970 36 p refs Transl. into ENGLISH from Izv. Glavnoi Astron. Observ. (Pulkovo), no. 185, 1970 p 167 - 182
(NLL-RTS-6097) Avail: Natl. Lending Library, Boston Spa, Engl.: £3.50; 12 photocopy coupons

A detailed study of the mean statistical properties of local sources is presented, based on observations made with a large radio telescope from 1964 through 1966, including data obtained during solar eclipses. The development of the local sources, closely linked with their corresponding groups of sunspots, is characterized. The spectra of the local sources are studied, and regular laws of development are outlined. The structure and nature of the local sources are also discussed. N.E.N.

08 COMPUTERS

Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics

N71-28003*# Fairchild Space and Defense Systems, Syosset, N.Y.
AUTOMATIC DATA CORRELATION SYSTEM STUDY. VOLUME 2: SYSTEM DESIGN Final Report, 1 Jul. 1969 - 30 Jun. 1970
24 Jul. 1970 298 p
(Contract NAS9-9842)
(NASA-CR-115063) Avail: NTIS CSCL 09B

A design study for an automatic data correlation system of the Earth Resources program is presented. The problems of correlating remotely sensed earth surface data with other similar data and of correlating these data with the earth's surface are considered. A functional ground data processing system is described which is designed to handle all identified classes of remote sensor data on a large-volume, high-throughput basis. With that as a reference, a specific pilot system configuration is recommended which, where possible, uses equipments already available. Author

N71-28004*# Fairchild Space and Defense Systems, Syosset, N.Y.
AUTOMATIC DATA CORRELATION SYSTEM STUDY. VOLUME 1: PROGRAM SUMMARY Final Report, 1 Jul. 1969 - 30 Jun. 1970
24 Jul. 1970 57 p refs
(Contract NAS9-9842)
(NASA-CR-115062) Avail: NTIS CSCL 09B

The problems of correlating remotely sensed earth surface data with other similar data and of correlating these data with the earth's surface are summarized. A functional ground data processing system is described which is designed to handle all identified classes of remote sensor data on a large-volume, high-throughput basis. With that as a reference, a specific pilot system configuration is recommended which, where possible, uses equipments already available. Author

N71-28088*# Cornell Univ., Ithaca, N.Y. School of Electrical Engineering.
STUDY OF SEQUENTIAL DECODING
Frederick Jelinek Sep. 1970 176 p refs
(Contract NAS2-5643)
(NASA-CR-114277) Avail: NTIS CSCL 09D

Problems of reliable transmission through noisy space channels are discussed including sequential decoding and the Stack algorithm, the bootstrap hybrid scheme, and development of good convolutional codes and a bootstrapping hybrid approach to the Viterbi decoding algorithm. Problems of encoding of space sources for the purpose of data compression are outlined including tree encoding with fidelity criterion and permutation encoding with a fidelity criterion. The results are summarized and their implications are discussed. Author

N71-28160*+ Rensselaer Polytechnic Inst., Troy, N.Y.
COMPENSATOR DESIGN FOR LOW SENSITIVITY LINEAR TIME-INVARIANT SYSTEMS, VOLUME 2 Final Report, 4 Nov. 1969 - 4 Apr. 1971
Lutz Willner Jun. 1971 186 p refs
(Contract NAS8-21131)
(NASA-CR-119798) Avail: NTIS CSCL 09B

The design of feedback compensators to obtain linear time-invariant systems which are insensitive to parameter variations is reported. A new concept in sensitivity design is introduced. A sensitivity function is derived, based on a condition number in a matrix which transforms the system under consideration to diagonal form. The knowledge of the condition number permits the computation of a bound on permissible parameter variations for which the closed loop system will still exhibit a specified minimum stability. An algorithm to locally minimize the sensitivity function with respect to the compensator parameters is developed, programmed for the digital computer and applied to the design of three systems. A fast and efficient pole-placement algorithm and an algorithm to determine the condition number are also developed. Author

N71-28277# Massachusetts Inst. of Tech., Cambridge.
THE SUBSTANTIVE USE OF COMPUTERS FOR INTELLECTUAL ACTIVITIES
Robert C. Goldstein Apr. 1971 19 p refs Sponsored in part by ARPA
Contract N00014-69-A-0276-0002; Proj. MAC)
D-721618; MAC-TM-21) Avail: NTIS CSCL 9/2

The paper discusses an on-going research project aimed at developing computer facilities capable of providing substantive aid to a human decision maker concerned with complex, unstructured problems. The rationale for such systems is discussed, followed by an outline of the approach used. Some results of preliminary experiments are also discussed, as well as plans for future activities. Author (GRA)

N71-28279*# Philco-Ford Corp., Palo Alto, Calif.
MANIPULATION ERRORS IN COMPUTER SOLUTION OF CRITICAL SIZE STRUCTURAL EQUATIONS
R. J. Melosh Washington Jun. 1971 47 p refs
(Contract NAS5-10362)
(NASA-CR-1784) Avail: NTIS CSCL 09B

Errors that arise from digital computer solutions of structural problems using the finite element method are explored. Measured errors are reported and interpreted for problems involving the number of calculations ranging up to the critical number, i.e. the base 2 raised to the power equal to the bits in the computer word. Structures whose connections are in series, parallel, and a combination of both are examined against eight error measures. Error measures are found to be sensitive to error measuring and problem details such as loading, sequencing, and the definition of norm. Four error measures are recommended for the displacement method analysis. Author

N71-28327# Mitre Corp., Bedford, Mass.
AIRCRAFT MOCK-UP COMPUTER PROGRAM SPECIFICATIONS
Richard E. Zapolin Mar. 1971 77 p
(Contract F19628-71-C-0002)
(AD-721673; MTR-1995; ESD-TR-71-80) Avail: NTIS CSCL 9/2

A computer program operating in the DEC PDP-15 will simulate programs in avionics computers aboard the two simulated jet aircraft. General performance and design specifications for this computer program, program organization, and a phasing plan are presented. Author (GRA)

N71-28409# Naval Postgraduate School, Monterey, Calif.
A METHOD FOR THE SIMULATION OF A HELICOPTER IN A TACTICAL ENVIRONMENT USING RAND'S TACTICS PROGRAM
Robert Alex Maier (M.S. Thesis) Mar. 1971 89 p refs
(AD-721567) Avail: NTIS CSCL 9/2

The TACTICS computer program developed by the RAND Corporation has the capability of simulating three-body, three-dimensional tactical situations. This study investigates the problem of using the TACTICS program when one of the bodies is to have the characteristics of a helicopter. The difference between the forces acting on a helicopter and the forces assumed by the TACTICS program are discussed, and a method to simulate the helicopter is presented. The basic idea of this method is to 'fly' a hypothetical fixed-wing aircraft with parameters which enable it to perform like a helicopter. The programming required to simulate several basic helicopter maneuvers is discussed, and two examples of a helicopter in a tactical environment are presented. Author (GRA)

N71-28420*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DIGITAL DATA PROCESSOR WHEREIN OPERATIONS ARE CONDITIONALLY PERFORMED IN RESPONSE TO THE STATE OF INDICATORS WITHIN THE PROCESSOR Patent Application
Robert J. Lesniewski, inventor (to NASA) 25 p Filed 23 Dec. 1970
(NASA-Case-GSC-10975-1; US-Patent-Appl-SN-100996) Avail: NTIS CSCL 09B

The digital data processor includes means for deriving binary signals indicative of the state of various indicators within the processor. One of the indicator signals is selectively fed through a first switch having a single output lead. The indicator output signal is fed to a second switch responsive to a command signal source and pulses from a clock source. In response to one component of the command signal source having a predetermined value, pulses from the clock source are invariably fed through the second switch. In response to the other state of the one component, pulses from the clock source are selectively gated through the second switch, depending upon the relative values of binary signals derived from the first named switch and a second component of the command signal source. Computers contained in the spacecraft are particularly well suited to use the processor. NASA

N71-28521*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DIGITAL IMAGE PROCESSING FOR THE RECTIFICATION OF TELEVISION CAMERA DISTORATIONS
Thomas C. Rindfleisch *In* Princeton Univ. Astron. Use of Television-Type Image Sensors 1971 p 145 166 refs (See N71-28509 16-30)
(Contract NAS7-100)
Avail: NTIS CSCL 09B

The rectification of distortions which influence the results of quantative photometric and geometric measurements introduced into the imagery recorded by television systems is discussed. Method which have been developed and applied for the removal of structured system noises and the correction of photometric, geometric, and resolution distortions in vidicon systems are briefly described. Examples are given of results derived primarily from the Mariner Mars 1969 television experiment. Author

N71-28523*# Aerospace Corp., El Segundo, Calif.
REAL TIME COMPUTER PROCESSING OF VIDEO IMAGES
T. J. Janssens, N. K. Baker, and E. E. Robbins (NASA, Manned Spacecraft Center) *In* Princeton Univ. Astron. Use of Television-Type Image Sensors 1971 p 193 198 (See N71-28509 16-30)
Avail: NTIS CSCL 09B

The application of digital and computing techniques to television images in real time for the measurement of solar magentic

fields is described. The digital video processor consists of sections for data gathering, display, and data storage. Some applications of real time computing on video images are given. F.O.S.

N71-28631# California Univ., Livermore. Lawrence Radiation Lab.
WEAPONS EFFECTS DISPLAY SYSTEM (WEDS MOD II): MATHEMATICAL MODELS USED FOR CALCULATIONS, VOLUME 1
C. W. Berndt and D. E. Ferguson Jan. 1971 26 p refs Sponsored by AEC
(UCRL-50892) Avail: NTIS

A description of the mathematical models used to develop the computer programs for both the prompt nuclear effects and the fallout calculations used by the Weapons Effects Display System (WEDS MOD 2) is presented. The assumptions made to simplify these programs are noted and sources of error are discussed. Desirable features for greater utility and possible inclusion in a next generation of machines are described. Author (NSA)

N71-28632# Syracuse Univ., N.Y. Dept. of Electrical Engineering.
COMPUTER PROGRAMS FOR CHARACTERISTIC MODES OF WIRE OBJECTS
Joseph R. Mautz and Roger F. Harrington Mar. 1971 79 p refs
(Contract F19628-68-C-0180)
(AD-722062; AFCRL-71-0174; SR-11) Avail: NTIS CSCL 9/2

Computer programs for calculating the characteristic modes of wire objects of arbitrary shape are given. A program for computing the generalized impedance matrix of wire objects is included. It is valid for systems of N wires of arbitrary shape, using triangle functions for both expansion and testing. A program for using the characteristic modes in plane-wave scattering problems, showing convergence of the modal solution, is also given. Programs for making Calcomp plots of the characteristic currents, gain patterns and modal solutions are included. This report gives program descriptions, operating instructions, listings, and sample input-output data for each program. Author (GRA)

N71-28791 Oregon State Univ., Corvallis.
ASYMPTOTIC CONVERGENCE TECHNIQUE AND EXECUTIVE CONCEPT FOR STEADY STATE PROCESS SYSTEMS ANALYSIS
Young Jin Kwon (Ph.D. Thesis) 1969 166 p
Avail: Univ. Microfilms Order No. 70-14137

An executive system for steady state process systems analysis is developed to promote maximum flexibility, generality and a high degree of man-machine interaction. The user may write a Fortran main calling program which permits special logic and control to be introduced to suit the needs of a particular simulation problem. Development of the calling program is assisted by topological ordering algorithms and extensive executive subprograms for efficient convergence of complex recycle net calculations. An asymptotic convergence technique is also developed and compared with other convergence techniques commonly used in process calculations. The algorithms are compared by evaluating nine systems for each convergence algorithm. The criteria chosen for the comparison include the number of system evaluations, storage requirement and stability of the iteration process. Dissert. Abstr.

N71-28925* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DIGITAL MEMORY SENSE AMPLIFYING MEANS Patent
George C. Milligan, inventor (to NASA) Issued 23 Jul. 1968 4 p Filed 21 May 1964 Cl. 340-174 Sponsored by NASA
(NASA-Case-XNP-01012; US-Patent-3,394,359;
US-Patent-Appl-SN-369338) Avail: US Patent Office CSCL 09B

A magnetic core memory is described in which sensing circuits are connected in parallel with interrogate windings for sensing the state of memory cores coupled to the windings. The memory is comprised of a plurality of magnetic cores respectively arranged in rows and columns. Each of the magnetic cores constitutes a multi-aperture device and is capable of defining a 1 state, a 0 state, and a prime state. A plurality of interrogate windings are provided with each being coupled to the cores of a different one of the columns. Interrogate means apply signals to the interrogate windings in a direction to switch the cores coupled thereto to a 1 state. Those core elements defining a prime state will present a relatively high impedance so that the applied signal will be diverted to the lower impedance sensing circuit. Official Gazette of the U.S. Patent Office

N71-29024# Montpellier Univ. (France). Dept. of Physique Mathematique.
COMPUTER STUDY OF SOLUTION METHOD FOR INVERSION PROBLEM [ETUDE DE ORDINATEUR D'UNE METHODE DE RESOLUTION DU PROBLEME INVERSE]
F. Quyen van Phu Jun. 1970 73 p refs In FRENCH
(PM/70/5) Avail: NTIS

The validity and accuracy of the Newton method for calculating nonrelativistic collision potential phase differences were evaluated by computer. Utilized are matrix inversion problems for obtaining the potential that reproduces at considerable energy the complete phase difference generated by a reference potential of a differing class. This problem is applied in the functional analyses of the parameters: energy, perturbation, and potential form. The energy analysis is based on the motion between the obtained potential and the potential loss with the decreasing energy. Introduction of perturbations at various phase points gives a potential representing the perturbation form. Calculations of phase displacements as function of potential form factor at 400 MeV produced a smoothly declining curve with a low level region that agreed well with the experimentally observed 400 MeV potential curve. Transl. by G.G.

N71-29033* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SAMPLED DATA CONTROLLER Patent
James A. Gatlin, inventor (to NASA) Issued 18 May 1971 13 p Filed 29 May 1969 Cl. 235-150.1; Cl. 235-151.1; Cl. 235-150.27; Cl. 235-150.2; Int. Cl. G05b21/02; Int. Cl. G05b11/10; Int. Cl. G05d1/08
(NASA-Case-GSC-10554-1; US-Patent-3,578,957;
US-Patent-Appl-SN-828984) Avail: US Patent Office CSCL 09B

A sampled data feedback controller is described which includes means for deriving a plurality of error signals within a single control formulation time interval. The error signals are derived by comparing the response of a plant with a reference input, constant over the interval, in a servo subtraction node. Each of the sampled errors is applied to an accumulator with a weighting factor, having a value selected on a predetermined basis, determined by the plant characteristics, to provide finite plant settling time. At the end of each control formulation interval the previous output of the accumulator is fed back to the accumulator, through a weighting factor network. The output of the accumulator at the end of each formulation interval is applied as a control input to the plant. In a specifically disclosed embodiment, the plant is a spin stabilized, attitude controlled satellite.
Official Gazette of the U.S. Patent Office

N71-29034* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DIGITAL FILTER FOR REDUCING SAMPLING JITTER IN DIGITAL CONTROL SYSTEMS Patent
Tage O. Anderson and William J. Hurd, inventors (to NASA) Issued 18 May 1971 6 p Filed 23 Dec. 1969 Cl. 328-167; Cl. 328-44; Cl. 307-207; Cl. 307-222; Int. Cl. H03k21/18 Sponsored by NASA
(NASA-Case-NPO-11088; US-Patent-3,579,122;
US-Patent-Appl-SN-887701) Avail: US Patent Office CSCL 09B

A digital filter is described which has two up-down counters A and B. Counter A which is responsive to a sampled input signal which is quantized into three levels +1, −1 and 0, is incremented in response to each +1 input, decremented in response to each −1 input, and remains unchanged in response to a 0 input. Counter B, which includes N stages, is incremented at each sampling time when A is positive, decremented when A is negative and remains unchanged when A is zero. When B overflows in a positive direction A is decremented by one while a negative overflow of B results in A being incremented by one. The filter output is +2(1N) when A is positive, −2(1N) when A is negative and zero (0) when the count in A is zero. Official Gazette of the U.S. Patent Office

N71-28138* Kollsman Instrument Corp., Syosset, N.Y.
DIGITAL MODULATOR AND DEMODULATOR Patent
Murray F. Cohen, inventor (to NASA) Issued 18 May 1971 4 p Filed 31 Dec. 1969 Cl. 332-9R; Cl. 307-234; Cl. 307-265; Cl. 328-58; Cl. 324-106; Cl. 332-10; Int. Cl. H03k7/08; Int. Cl. H03k9/08 Sponsored by NASA
(NASA-Case-ERC-10041; US-Patent-3,579,146; US-Patent-Appl-SN-889478) Avail: US Patent Office CSCL 09B

The design of an apparatus for generating an output signal commensurate with the information contained in an input signal is discussed. The modulation index of a pulse width modulated signal is determined by employing the input signal, as synchronized with a reference signal, to control a gate which passes high frequency pulses to an up-down counter. The output of the counter will be a positive or negative count having a magnitude commensurate with the degree of pulse width modulation of the input signal. Official Gazette of the U.S. Patent Office

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N71-28176# Varian Associates, Palo Alto, Calif. Tube Div.
TRANSMITTER TUBE FOR TROPOSCATTER APPLICATION Triannual Report No. 1, 8 Jun. −7 Oct. 1970
G. Huffman, A. Goldfinger, and M. Levin Mar. 1971 37 p refs
(Contract DAAB07-70-C-0228)
(AD-721362; ECOM-0228-1) Avail: NTIS CSCL 9/1

The program objective is to study and establish the design criteria for a high efficiency, high gain, high power klystron final amplifier stage operating in the 4.4 to 5.0 GHz range. The klystron final amplifier is defined as the klystron tube plus its focusing and cooling schemes. The objective power level is 10 kW CW and the objective final amplifier efficiency is 47 percent. A klystron design tradeoff analysis was made and a scheme using second harmonic space-charge bunching was chosen; a study was undertaken to determine the most efficiency and practical focusing scheme; and a magnet design computer program was written for more convenient study of the various materials and coil configurations, with intention of selecting a coil design for optimum efficiency. The program and a sample case are presented here. A coolant study is in progress to choose a cooling scheme which will meet the requirements of a practical, reliable, and efficient system. Results thus far point to a vapor phase (ebullient) cooling system using a water/Dowtherm 209 mixture, but final selection of fluid and system have not been made. A preliminary study to determine the best cavity design has begun but definitive conclusions have not yet been reached. Author (GRA)

N71-28218# Army Missile Command, Redstone Arsenal, Ala. Directorate for Research Development.
A SURVEY OF SECOND BREAKDOWN PHENOMENA, MECHANISMS, AND DAMAGE IN SEMICONDUCTOR JUNCTION DEVICES
Paul P. Budenstein 10 Dec. 1970 70 p refs
(AD-721294; RD-TR-70-19) Avail: NTIS CSCL 9/1

The report describes the phenomena associated with second breakdown. To explain these, a variety of thermal and electrical theories have been offered. None of these have earned general acceptance, although each can explain certain aspects of second breakdown. The theoretical basis of the second breakdown problem is discussed and representative theoretical treatments are presented. A new model of second breakdown, based on tunnel emission in an avalanching junction, is offered. The details of this model, however, remain to be worked out. The motivation for this work is to arrive at some conclusions on how to predict the second breakdown behavior of transistors in terms of geometry and circuital environment and, if possible, to suggest ways of improving transistor device and circuit design for better second breakdown resistance. Author (GRA)

N71-28219# Army Electronics Command, Fort Monmouth, N.J.
GUIDELINES FOR SOLID STATE FLAT PANEL DISPLAYS. PART 1: DISPLAY EFFECTIVENESS FACTORS
Mortimer H. Zinn and Elliott Schlam Jan. 1971 31 p refs
(AD-721307; ECOM-3384) Avail: NTIS CSCL 9/1

The display-effectiveness factors, when properly evaluated, determine the suitability of a particular display device for a specific application. These factors are brightness, contrast, half-tone capability, resolution, flicker, distortion (or, conversely, accuracy), blemishes, volume-to-display-area ratio, and power consumption. While only qualitative standards can be established for most of these factors, they serve a highly useful purpose for system analysis. The cathode-ray tube satisfactorily meets most of the display requirements, falling short particularly in military equipments in the volume-to-display-area ratio factor. The limits of the state of the art of solid-state displays at this time can be delineated. The analysis indicates that at the present time the solid-state display should be limited to low total-element requirements, where a flat display is an absolute requirement, because of limitations in light output, spectral characteristics, power consumption, and element cost. These factors indicate the characteristics that must be improved in order to obtain a wider application of solid-state displays. Author (GRA)

N71-28233# Technische Hogeschool, Delft (Netherland). Afdeling der Technische Natuurkunde.
NEGATIVE RESISTORS AND NEGATIVE CONDUCTORS
Adolf Fritz Schwarz (Ph.D. Thesis) Feb. 1969 159 p refs
Avail: NTIS

Two classes of physical components exhibiting a dual behavior are investigated. Feasible realizations and physical limitations of negative resistors and conductors are discussed and some applications shown. ESRO

N71-28306# Naval Underwater Systems Center, New London, Conn.
ANALYSIS AND COMPUTER PROGRAM FOR TEMPERATURE DISTRIBUTION IN A HOLLOW CYLINDRICAL CERAMIC TRANSDUCER ELEMENT
Russell W. Dunham 15 Dec. 1970 34 p
(AD-721678; NUSC/NL-4011) Avail: NTIS CSCL 9/1

The problem of temperature distribution in a hollow cylindrical ceramic element in a sonar transducer under operating conditions is analyzed using the appropriate Greens function. The boundary conditions are taken to be (1) prescribed temperatures over the axial ends and (2) Newtons law of cooling satisfied over the inside

and outside radial surfaces. Equilibrium conditions are presented for determining a compatible temperature for the trapped interior gas if the temperatures of the axial ends and the exterior gas are known. Computer Program S1656 provides a convenient means of calculating the temperature distribution in such ceramic cylinders. Author (GRA)

N71-28307# New Mexico Univ., Albuquerque. Bureau of Engineering Research.
RADIATION HARDENED GaAsP MIS FIELD EFFECT TRANSISTOR FEASIBILITY STUDY
W. W. Grannemann and D. H. Phillips Dec. 1970 77 p refs
(Contract N00014-68-A-0158)
(AD-722059; EE-179(70)ONR-005) Avail: NTIS CSCL 9/1

A study has been performed to examine the feasibility of developing a radiation-hardened GaAsP MISFET IC technology. Particular attention has been given to the question of whether the theoretical advantages of GaAsP over silicon are sufficient to warrant the development of the GaAsP MISFET technology. The advantages of high electron mobility, high temperature operation, thermal annealing of radiation damage, low radiation-induced photocurrent response, unique dielectric isolation adaptability, and resistance to thermal shock from a nuclear burst are discussed. This technology-development feasibility study evaluates the characteristics of the devices which could be fabricated if the GaAsP MISFET technology is developed. Equations are developed which describe the circuit performance of a p-channel MIS-load, inverter circuit. A study of these equations shows how materials parameters (mobility, permittivity, etc.) affect the performance of both GaAsP and silicon inverters. Author (GRA)

N71-28326*# Consolidated Controls Corp., Bethel, Conn.
SPACE CHARGE EFFECTS IN A VACUUM THERMIONIC DIODE
Anthony J. Cassano 30 Apr. 1971 44 p
(Contract NAS3-4170)
(NASA-CR-72885) Avail: NTIS CSCL 09A

A refined diode space-charge model was developed which includes emission from both the emitter and collector electrodes. Analysis of the model was checked by vacuum diode experiments conducted over a collector temperature range of 1000-1600 F. Reasonable correlation was obtained, indicating the validity of the model. Author

N71-28342# Naval Postgraduate School, Monterey, Calif.
STUDY OF TRANSISTOR LINEAR AND SWITCHING VOLTAGE REGULATORS FOR USE IN POWER CONDITIONING
Thomas Joseph Solak (M.S. Thesis) Dec. 1970 63 p refs
(AD-721570) Avail: NTIS CSCL 9/5

A requirement exists for a portable direct energy source 60 watt power supply with adjustable output voltage between 24 and 28 volts. Integrated circuit and discrete transistor linear and switching voltage regulators with these outputs were designed, breadboarded and tested with intent toward use in such power supplies. A summary of design characteristics of the transistors and circuits is given, while the resulting test data is presented in tabular and graphical form. A feasibility study of using the tested regulators in conjunction with a dc-dc converter to form a power conditioner is also presented. Author (GRA)

N71-28343# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
MOTORS, ELECTRICAL Final Report
23 Feb. 1970 89 p refs
(AD-721611; MTP-9-2-155) Avail: NTIS CSCL 9/3

The Engineering Test Procedure describes test methods and techniques for evaluating the technical performance and characteristics of electrical motors, and for determining the items suitability for U. S. Army use. Author (GRA)

N71-28344# Naval Postgraduate School, Monterey, Calif.
FAULT ISOLATION USING FREQUENCY RESPONSE TECHNIQUES
Charles Gilbert Martinache (M.S. Thesis) Sep. 1970 77 p refs
(AD-721582) Avail: NTIS CSCL 9/5

An investigation of using the response of a circuit at selected test frequencies to isolate faulty circuit components is made. A procedure using a sensitivity approach for intelligent selection of test frequencies is developed. The developed procedure is tested and the results are compared with results using conventional procedures. The effect of random, within tolerance variations of nonfaulty components on the results is studied for both conventional and developed procedures. Author (GRA)

N71-28348# Sylvania Electric Products, Inc., Seneca Falls, N.Y. Electronic Tube Div.
LOW POWER DRAIN, 2 IN × 6 IN CATHODE RAY TUBE Final Report, 30 Jun. – 29 Dec. 1970
George E. Hassler Mar. 1971 25 p
(Contract DAAB07-70-C-0244)
(AD-722207; ECOM-0244-F) Avail: NTIS CSCL 9/1

The objective of the contract was to develop a new, low power drain, 2 in x 6 in rectangular display cathode ray tube suitable for battery operated service. The device is an expanded and modified version of the 3BGP1. Because of the high aspect ratio of the display area, the width being 3 times the height, major efforts were the design and fabrication of a glass envelope with sufficient strength, keeping within the specified physical dimensions and defining production capability requirements. In addition to a unique bulb design, this tube features two types of deflection: electro static on the short axis and electromagnetic on the long axis. The cathode ray tube was designated as Sylvania type SP5108P1. The report covers work on design and tooling of a bulb, design and fixturing the required electron gun, and development of a suitable deflection yoke. Test results and recommendations for continued product developed are included. Author (GRA)

N71-28355# Naval Postgraduate School, Monterey, Calif.
A NEAR-FIELD INVESTIGATION OF TWO UNIFORMLY PERIODIC LOOP ARRAYS
Ersan Tezmen (M.S. Thesis) Dec. 1970 67 p refs
(AD-721592) Avail: NTIS CSCL 9/5

The k-beta diagrams for two different uniformly periodic loop antenna arrays are determined from measured near field amplitude and phase distributions of waves traveling on the structures. It is found that there are frequency regions where these structures function as effective radiators. The directional characteristics of the radiated fields depend upon the relative phase and amplitude distributions of the near fields. The k-beta diagrams of these periodic antennas are used to predict the behavior of their tapered broadband versions. The results of this study demonstrate that providing appropriate conditions of phasing are met, backfire radiation can be established and, in turn, a successful broadband antenna can be designed. Author (GRA)

N71-28356# Naval Postgraduate School, Monterey, Calif.
NOISE ACTIVATED AUTOMATIC VOLUME CONTROL
Andrew Ford Hobson (M.S. Thesis) Dec. 1970 56 p refs
(AD-721596) Avail: NTIS CSCL 9/5

Communications operators who must use receivers in a noisy audio environment without earphones are plagued by the effect of a varying background noise level. Often the operators are simultaneously performing other tasks and thus can only monitor voice circuits. As the noise level varies the operator must repeatedly adjust the volume control for a comfortable listening

level. An analysis of the physical situation is presented. An automatic feedback control system that measures the predominant range of frequencies of the background noise and automatically adjusts the volume control of a power amplifier for a satisfactory listening level is developed. This system relieves the operator of the task of manual volume control and reduces the effect of noise masking. Author (GRA)

N71-28397# Naval Postgraduate School, Monterey, Calif.
SYNTHESIS OF DIGITAL FILTERS FROM FREQUENCY SPECTRUM CHARACTERISTICS
Arthur Laurent Partarrieu (M.S. Thesis) Sep. 1970 96 p refs
(AD-721571) Avail: NTIS CSCL 9/5

A comparison of standard z transform and algebraic substitution synthesis methods for digital filters are presented with emphasis on the frequency domain characteristics. A generalization of Martins procedure, which leads to recursive filters, is obtained. Also a new method to synthesize a digital filter from a magnitude squared versus frequency characteristic specification is presented. Author (GRA)

N71-28405# General Motors Corp., Kokomo, Ind. Delco Electronics Div.
RELIABILITY EVALUATION OF PLASTIC INTEGRATED CIRCUITS
John R. Bevington, James P. Cook, David R. Little, and L. V. Ingle Griffis AFB RADC Jan. 1971 175 p
(Contract F30602-69-C-0154)
(AD-722043; RADC-TR-71-8) Avail: NTIS CSCL 9/5

Insufficient information has been available with respect to the long-term stability of plastic-encapsulated microcircuits. Of special interest is the degree of susceptibility of these plastic packages to such environmental stresses as moisture resistance (with and without bias) and thermal shock. The objectives of the study are to determine the suitability of representative, production, plastic-encapsulated integrated circuits for military applications, and to develop methods and techniques for assessing and assuring the reliability of such circuits. A series of screens and tests were performed on selected circuits, and detailed failure analyses were made to determine the failure modes and mechanisms characteristic of the various types of plastic encapsulation. The report includes detailed test results from long-term tests and from short-term highly accelerated tests. Comparisons are made between package types under the same stress conditions, between screened and unscreened groups, and between standard and accelerated test results. A stress to destruction test program, including equivalent hermetic types for direct comparison with plastic-encapsulated devices under selected accelerated test conditions, was performed. Author (GRA)

N71-28408# California Univ., Berkeley. Electronics Research Lab.
STUDY OF THE PHENOMENA KNOWN AS RAPID ANNEAL IN TRANSISTORS Final Report, 1 Apr. – 30 Nov. 1970
W. G. Oldham and S. Naik Jan. 1971 77 p refs
(Contract F19628-70-C-0213; Grant AF-AFOSR-1488-68)
(AD-721743; ERL-71-1; AFCRL-71-0031) Avail: NTIS CSCL 9/1

Transient and steady state measurements are made on junction field effect transistors. A theory for the static characteristics of JFETs is developed based on a single defect energy level. The theory takes into account both the behavior of the space-charge region and compensation in the neutral channel due to neutron-induced defects. Transient measurements of JFET properties are made following exposure to a pulse of neutrons. Transient annealing of the drain to source resistance is observed in both n and p-channel JFETs. Annealing factors of about 0.0015 sec after irradiation are typical. Author (GRA)

N71-28407# Army Electronics Command, Forth Monmouth, N.J.
CRYOGENICALLY CRUSHED Ni Zn FERRITES
Janina J. Mitchell Mar. 1971 21 p refs
(AD-721587; ECOM-3399) Avail: NTIS CSCL 13/8

A high density Ni Zn ferrite, with high permeability and high Q factor for RF applications, has been developed by utilizing a new cryogenic crush procedure. In this procedure, extensive grinding, which is normally required to obtain small particle size, is replaced by crushing the calcined ferrite under liquid nitrogen plus a short ball mill cycle prior to sintering. Permeabilities of 20 at a Q of 100 were obtained on toroidal samples tested at 350 MHz. Magnetic properties were determined by applying a bias field greater than needed for resonance parallel to the axis of the toroid. The study includes the effects of hot-pressing temperature and crushing procedure variables on the magnetic and physical properties of the ferrite. Author (GRA)

N71-28410# Sperry Rand Corp., Huntsville, Ala. Space Support Div.
A SOLUTION FOR DEGRADATION IN SHIELDING EFFECTIVENESS OF LARGE CONDUCTING SHEETS DUE TO WELD DEFECTS AS BASED ON BABINET'S PRINCIPLE Final Report
A. T. Bolt and D. J. Kozakoff May 1970 19 p refs
(Contract DACA87-69-C-0009)
AD-721907; SR-48114-A) Avail: NTIS CSCL 9/1

For shielded enclosures much larger than a wavelength, the infinite sheet analysis is applicable. Defects in these enclosures, such as weld objects, are viewed as rectangular apertures. The equivalence principle allows replacement of the slot with an equivalent dipole to study propagation through the defect. Because of the approximations employed, the results are conservative. Propagation through an infinite sheet of good conductivity is presented. Formulas for fields transmitted through slots are developed. A comparison is made between these results and Kadens solution for the circular aperture. Examples are included with the results presented parametrically. Author (GRA)

N71-28414# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
GOUNDING ELECTROTECHNICAL ASSEMBLIES UNDER PERMAFROST CONDITIONS [ZAZEMLENIE ELEKTRO-TEKHNICHESKIKH USTANOVOK V USLOVIYAKH VECHNOI MERZLOTY]
V. E. Nozhevnikov 1971 7 p Transl. into ENGLISH from the Russian
(AD-722221) Avail: NTIS CSCL 9/3

The report discussed the problem of choosing the type of grounds and the kind of ground network in the presence of a layer of permafrost soil. GRA

N71-28419*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A dc TO ac TO dc CONVERTER HAVING TRANSISTOR SYNCHRONOUS RECITIFIERS Patent Application
Edward R. Pasciutti, inventor (to NASA) 21 p Filed 16 Dec. 1970
(NASA-Case-GSC-11126-1; US-Patent-Appl-SN-98640) Avail: NTIS CSCL 09E

A dc to ac inverter including a pair of transistors driven in push-pull by means of coupling through first and second transformers, each having a saturable core, drives a dc load through a synchronous rectifier. The synchronous rectifier includes a pair of transistors, the emitter collector junctions of which are driven with the same waveshape as the emitter base junctions of the inverter. A circuit connecting the two transformers together includes a saturable reactor, whereby the base drive for the transistors of the inverter and the synchronous recitifier is a waveform having two

relatively steep transitions in opposite directions at the moment of switch on to remove charge stored on the bases and a further relatively steep transition prior to cut off to minimize charge stored on the bases during nonconducting intervals of the transistors.
NASA

N71-28421* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CAVITY EMITTER FOR THERMIONIC CONVERTER Patent
Katsunori Shimada, inventor (to NASA) Issued 18 May 1971 11 p Filed 17 Oct. 1968 Cl. 310-4; Int. Cl. H01J45/00
Sponsored by NASA
(NASA-Case-NPO-10412; US-Patent-3,578,992; US-Patent-Appl-SN-768470) Avail: US Patent Office CSCL 09A

A thermionic cesium diode incorporating a cavity emitter is described. The emitter defines relatively shallow cavities extending inwardly from the surface which faces the interelectrode gap. The depths of the cavities are comparable with the electron-neutral mean free path and the ratios of the depths of the cavities to their diameters are large enough to neutralize electron space charge.
Official Gazette of the U.S. Patent Office

N71-28468* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
MULTIVIBRATOR CIRCUIT WITH MEANS TO PREVENT FALSE TRIGGERING FROM SUPPLY VOLTAGE FLUCTUATIONS Patent
Gregory L. Schaffer, inventor (to NASA) Issued 8 Jun. 1971 5 p Filed 13 Feb. 1969 Cl. 328-207; Cl. 307-265; Cl. 307-273; Cl. 307-288; Int. Cl. H03k3/10
(NASA-Case-ARC-10137-1; US-Patent-3,584,311; US-Patent-Appl-SN-799013) Avail: US Patent Office CSCL 09E

A one shot multivibrator that produces long duration output pulses in which there is immunity against false triggering caused by power supply fluctuation or noises is described. The immunity against false triggering from power supply noises achieved by a constant current source. This source provides a constant current independent of fluctuations in the supply voltage for isolating the power supply noise from the timing circuit.
Official Gazette of the U.S. Patent Office

N71-28470*# Airborne Instruments Lab., Deer Park, N.Y.
HIGH-Q BANDPASS RESONATORS UTILIZING BANDSTOP RESONATOR PAIRS Patent Application
Herman Charles Okean, inventor (to NASA) 21 p Filed 27 Nov. 1970
(Contract NAS5-10657)
(NASA-Case-GSC-10990-1; US-Patent-Appl-SN-93329) Avail: NTIS CSCL 09E

High-Q bandpass resonators utilizing composite bandstop resonator pairs are described. The bandstop resonator pairs are formed of composite series or parallel connected realizable transmission line elements. The elements are exclusively either quarter-wavelength lines or half-wavelength lines.
NSA

N71-28471*# Honeywell, Inc., Minneapolis, Minn.
LOAD CURRENT SENSOR FOR A SERIES PULSE WIDTH MODULATED POWER SUPPLY Patent Application
Roland L. Hron, inventor (to NASA) 11 p Filed 31 Jul. 1970
(Contract NAS5-10440)
(NASA-Case-GSC-10656-1; US-Patent-Appl-SN-59969) Avail: NTIS CSCL 09E

A load current sensor is described for use with a pulse width modulated power source. The system comprises an output filter inductor connected in series between a load and a pulse width modulated regulator. This inductor stores a portion of each pulse supplied to the load by the regulator. At the end of each pulse the stored energy in the inductor causes the current to continue flowing through the load via a free wheeling diode. This current is sampled by a sensor which is connected across the free wheeling diode and the series circuit made up of the output filter inductor and the load. The sensor comprises a gated transistor switch connected in series with a pulse transformer. The free wheeling diode has a forward conductance threshold (forward resistance) which is greater in magnitude than the series impedance of the transistor switch and the pulse transformer.
NSA

N71-28519*# Northwestern Univ., Evanston, Ill. Lindheimer Astronomical Research Center.
AN ELECTRICAL READOUT TUBE FOR ASTRONOMICAL SPECTROSCOPY
Jay Burns *In* Princeton Univ. Astron. Use of Television-Type Image Sensors 1971 p 129-136 refs (See N71-28509 16-30)
Avail: NTIS CSCL 09E

The general features of an electrical readout image tube designed specifically for use on the LARC Coude spectrograph are described. This tube incorporates some unconventiokl features and is presented to illustrate how the special requirements of astronomical spectroscopy may be used advantageously to relax certain constraints ordinarily placed on image tube design by the shadow of television requirements. The two principal characteristics of astronomical spectroscopy that lead to novelty in the present design are the essentially one-dimensional nature of a spectrum and the freedom the astronomer has to read out his stored image slowly at some time after the exposure is made.
Author

N71-28525*# Naval Observatory, Washington, D.C.
THE PROCESSING OF ELECTRONIC CAMERA IMAGES
Gerald E. Kron *In* Princeton Univ. Astron. Use of Television-Type Image Sensors 1971 p 207-217 refs (See N71-28509 16-30)
Avail: NTIS CSCL 09E

The electronic camera is discussed as a useful astronomical tool for recording photometric and spatial data. The advantages of the electronic camera over the photoelectric approach to stellar photometry are given along with the storage capacity and deconvolution properties of the electronic camera.
F.O.S.

N71-28594# Battelle Memorial Inst., Columbus, Ohio.
THE STABILITY OF SiO2 PASSIVATION LAYERS Final Report, 12 Feb. 1970-12 Jan. 1971
Y. F. Chang Jan. 1971 30 p ref
(Contract N00019-70-C-0274)
(AD-721377) Avail: NTIS CSCL 11/3

Samples of SiO2 passivation layers were thermally grown on silicon wafers in completely dry atmospheres containing oxygen and nitrogen. The electrical characteristics of these samples in MOS capacitor structures were superior to those of wet-oxygen-grown samples. Analysis of these samples by ion-beam mass spectrometry revealed higher concentrations of impurities than those found in wet-grown SiO2 layers. The presence of certain amounts of metal impurities in the SiO2 apparently did not effect the stability of these layers. It would appear that the impurity atoms are mobile in the SiO2 only when moisture has penetrated the oxide layer. The thermal growth of SiO2 layers on silicon wafers in a completely dry atmosphere is sensitive to the condition of the quartz oxidation furnance tube. It was established that the quartz tube must be properly aged in dry oxygen before stable SiO2 layers can be produced.
Author (GRA)

N71-28618* National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
COLOR TELEVISION SYSTEMS USING A SINGLE GUN COLOR CATHODE RAY TUBE Patent
Edwin H. Hillborn and Ernest E. Gaiser, inventors (to NASA) Issued 1 Jun. 1971 9 p Filed 26 Nov. 1968 Cl. 178-5.2R; Cl. 178-54PE; Cl. 178-54CF; Int. Cl. H04n9/06
(NASA-Case-ERC-10098; US-Patent-3,582,960;

US-Patent-Appl-NS-779169) Avail: US Patent Office CSCL 09E

A description is given of the systems for controlling the three attributes of color (brightness, hue and saturation) in a single-gun, current-sensitive color cathode ray tube (CRT). Means are provided for modifying standard broadcast signals to permit the reception and display of imagery with this tube, or alternatively, for modifying a monochromatic closed circuit television system to display colored imagery.

Official Gazette of the U.S. Patent Office

N71-28681# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.

MULTIELECTRODE ULTRASONIC TRANSDUCER TEST TECHNIQUES FOR RADIOISOTOPE ENCAPSULATION INSPECTION

Dennis R. Newman and Robert W. Steffens Feb. 1971 25 p (Contract AT(45-1)-1830)

(BNWL-1491) Avail: NTIS

Receiving ultrasonic transducers with 32 individual electrodes in a linear array on single piezoelectric chips have been fabricated. Linear densities of 32 electrodes per 4, 2.5, and 1.5 cm have been obtained on 5 MHz PZT-5. Electronic circuits for sampling and reading out the individual electrodes at rates of up to 2000 samples per second have been developed, along with the mechanical systems necessary for scanning and manipulating the transducers. The transducers have been used for rapidly testing radioisotope capsules for clad-to-core unbonds and core voids or porosities.

Author (NSA)

N71-28691* National Aeronautical and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

METHOD OF MAKING SHIELDED FLAT CABLE Patent

Wilhelm Angele and Bobby W. Kennedy, inventors (to NASA) Issued 27 Apr. 1971 8 p Filed 23 Apr. 1968 Cl. 204-30; Int. Cl. C23b5/64

(NASA-Case-MFS-13687; US-Patent-3,576,723; US-Patent-Appl-SN-723488) Avail: US Patent Office CSCL 09A

A flat conductor cable having multiple ribbon-like conductors in spaced, parallel arrangement in a flat strip of insulating material is coated with a layer of shielding metal such as copper by roughening the surface of the insulating strip, contacting the strip with an electroless plating bath and then with an electrolytic plating bath. Contact of the metal shield with a ground conductor is obtained by exposing a portion of one or more conductors along the length of the cable prior to plating. An outer layer of insulating material is applied over the shielding layer.

Official Gazette of the U.S. Patent Office

N71-28737# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Serpukhov (USSR). Institut Fiziki Vysokikh Energii.

DEVICE WITH A SNAP-OFF DIODE FOR COMPENSATION OF THE INFLUENCE OF THE PULSE AMPLITUDE SPREAD OF THE SCINTILLATION AND CHERENKOV COUNTERS AT THE MOMENT OF TRIGGERING THE FAST SHAPERS [VSTROISTVO NA DIODE S NAKOPLENIEM ZARYADA DLYA KOMPENSATSII VLIYANIYA AMPLITUDNOGO RAZBROSA IMPUL'SOV STSINTILLYATSIONNYKH I CHERENKOVSKIKH SCHETCHIKOV NA MOMENT SRABATYVANIYA BYSTRYKH FORMIROVATELEI]

V. G. Lapshin, V. I. Ryalin, and Z. Tsisek 1969 17 p refs In RUSSIAN

(IFVE-SEF-69-44) Avail: AEC Depository Libraries

A device with a snap-off diode for compensation of the influence of the pulse amplitude spread on the time resolution in fast shapers is described. The results of testing this device are given. In the range of the amplitude change of the input pulses from 0.5 to 10 V of shift of the time distribution approximately 0.2 nsec. The dead time of the device is approximately 20 nsec.

Author (NSA)

N71-28768*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

SWITCHING REGULATOR Patent Application

Arthur G. Birchenough, inventor (to NASA) 9 p Filed 3 Nov. 1970

(NASA-Case-LEW-11005-1; US-Patent-Appl-SN-86548) Avail: NTIS CSCL 09E

A switch connected between an unregulated dc power source and a load is controlled by a variable conductance device which compares the load voltage to a reference voltage. If the load voltage tends to increase above a predetermined value the variable conductance device tends to reduce the conduction of the switch. A hysteresis network provides feedback to the variable conductance device to produce a cumulative action so that the switch will turn-off rapidly when the variable conductance device tends to reduce the conduction of the switch and, similarly, will turn-on rapidly when the variable conductance device increases the conduction of the switch.

Official Gazette of the U.S. Patent Office

N71-28769*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

SOLID STATE REMOTE CIRCUIT SELECTOR SWITCH Patent Application

Victor S. Peterson, inventor (to NASA) 11 p Filed 30 Sep. 1970

(NASA-Case-LEW-10387-1; US-Patent-Appl-SN-76899) Avail: NTIS CSCL 09A

A plurality of controlled rectifiers each associated with a respective load to be energized are provided along with gate circuitry for each controlled recitifier such that each controlled rectifier is sensitive to a control voltage that falls within certain limits. The limit are chosen to provide nonoverlapping ranges for the controlled rectifiers. Local selector circuits each include a bias voltage source whose output falls within respectie limits of the gate circuit nonoverlapping ranges. Switch means are provided whereby the voltage of the bias sources may be selectively applied to the gate circuits of the controlled rectifiers.

Official Gazette of the U.S. Patent Office

N71-28790 Iowa State Univ. of Science and Technology, Ames.

A MODAL SOLUTION OF THE MICROSTRIP TRANSMISSION LINE

Lawrence Griffith Heller (Ph.D. Thesis) 1969 49 p

Avail: Univ. Microfilms Order No. 70-13590

The electromagnetic fields of the shielded microstrip transmission line are found in terms of the normal modes of the dielectric slab waveguide. A method of summing the modes propagating transverse to the conductor is used to find the field representation. To check the solution, two separate limiting processes are shown to reduce the shielded microstrip transmission line to the stripline configuration. The discrete modal spectrum of the open microstrip transmission line is studied in detail. These modes are found to be a three-dimensional generalization of well-known two-dimensional surface waves. It is shown that the microstrip surface waves can exist without propagating away from the conductor. A graphical method is developed to determine the existence and the propagation properties of the surface wave modes associated with the microstrip line. It is found that predictions based on a two-dimensional surface wave analysis may be erroneous. A TM mode is found to exist on the microstrip at all frequencies.

Dissert. Abstr.

N71-28810* Hughes Aircraft Co., Culver City, Calif.

VARIABLE FREQUENCY OSCILLATOR WITH TEMPERATURE COMPENSATION Patent

Donald C. Mead and Elliott D. Lawrence, inventors (to NASA) Issued 13 Jun. 1967 6 p Filed 11 Mar. 1966 Cl. 331-113 Sponsored by NASA

(NASA-Case-XNP-03919; US-Patent-3,325,749; US-Patent-Appl-SN-535304) Avail: US Patent Office CSCL 09E

A variable frequency solid state oscillator which provides an output frequency related to an input signal supplied through an input buffer stage is described. The buffer stage includes a field effect transistor (FET) connected between the source of input signal and the oscillator. The gate-source voltage properties of the FET as a function of temperature are utilized to adjust the signal supplied to the oscillator so that its output frequency is substantially unaffected by temperature changes. The buffer stage is also used to raise the input impedance of the oscillator to above 10 megohms.
Official Gazette of the U.S. Patent Office

N71-28811*# Battelle Memorial Inst., Columbus, Ohio. Radiation Effects Information Center.
RADIATION EFFECTS DESIGN HANDBOOK. SECTION 1: SEMICONDUCTOR DIODES
C. L. Hanks and D. J. Hamman Washington NASA Jul. 1971 41 p refs
(Contract NASw-1568)
(NASA-CR-1785) Avail: NTIS CSCL 09A

This document contains summarized information relating to steady state radiation effects on semiconductor diodes plus an introductory section on terminology. The radiation considered includes neutrons, gamma rays, electrons, and protons. The information is useful to the design engineer for making estimates of radiation effects on diodes.
Author

N71-28823 Rhode Island Univ., Kingston.
EXISTENCE AND STABILITY OF INHERENT WAVEFORMS ON NONLINEAR TRANSMISSION LINES
Richard Joseph Buratti (Ph.D. Thesis) 1969 148 p
Avail: Univ. Microfilms Order No. 70-14146

By assuming the existence of a waveform propagating at a steady unknown velocity, the partial differential equation describing system behavior reduces to an ordinary differential equation. Conventional state space analysis was then utilized to determine possible inherent waveform solutions. For the class of transmission lines containing nonlinear conductances which were examined the existence of three types of inherent waveform solutions were found: a change of state waveform, a pulse waveform, and a periodic waveform. Stability was analyzed by examining the behavior of small linearized perturbations from the inherent waveform and by employing a generalization of Liapunov's second method. For the linearized system, the stability was equivalent to the Sturm-Liouville problem of determining the dependence of the eigenvalues in the Liouville equation on the boundary conditions.
Dissert. Abstr.

N71-28886* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A dc MOTOR SPEED CONTROL SYSTEM Patent
William M. McCampbell and Hershel M. Nance, inventors (to NASA) Issued 6 Apr. 1971 4 p Filed 16 Dec. 1971 Cl. 318-317; Cl. 318-331; Cl- 318-345; Cl. 318-504; Int. Cl. H02p5/16
(NASA-Case-MFS-14610; US-Patent-3,573,583; US-Patent-Appl-SN-885571) Avail: US Patent Office CSCL 09E

A motor speed control circuit is described wherein a signal proportional to the current resistance drop of the armature is utilized to drive a self excited inverter to obtain a feedback voltage equal to the current resistance drop of the armature. The feedback voltage is added as a positive feedback to a constant dc voltage to form the input to a unity gain amplifier. The last state of the amplifier is in series with the armature of the motor. The speed at which the motor operates is controllable by means of varying the value of the constant dc voltage.
Official Gazette of the U.S. Patent Office

N71-28901*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MICROPHONE MINIATURIZATION AND IMPROVEMENT Final Technical Report, 22 Jun. – 28 Aug. 1970
Alan Lipschultz and Paul Turer Aug. 1970 14 p
(NASA-TM-X-65580; X-207-70-474) Avail: NTIS CSCL 09E

Miniaturization of a crystal-type microphone for use with cardiography is described. A prototype miniature microphone was constructed, tested, and demonstrated.
G.G.

N71-28902*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
LOAD INSENSITIVE ELECTRICAL DEVICE Patent Application
Francisc C. Schwarz, inventor (to NASA) 34 p Filed 26 Mar. 1969
(NASA-Case-XER-11046; US-Patent-Appl-SN-810579) Avail: NTIS CSCL 09E

A class of power converters is described that supply direct current at one voltage from a source at another voltage which includes a simple passive circuit arrangement of solid state switches, inductors, and capacitors by which the output voltage of the converter tends to remain constant in spite of changes in load. The switches are sensitive to the current flowing in the circuit and are employed to permit the charging of capacitance devices in accordance with the load requirements. Because solid-state switches are used with relatively high voltages and high switching frequencies, power supplies can be substantially lighter in weight for a given output power level and efficiency of operation than other power conversion systems.
NASA

N71-28928* Westinghouse Electric Co., Pittsburgh, Pa.
MULTIPLE SLOPE SWEEP GENERATOR Patent
Martin G. Woolfson, inventor (to NASA) Issued 16 Jan. 1968 4 p Filed 26 Aug. 1965 Cl. 307-263 Sponsored by NASA
(NASA-Case-XMS-03542; US-Patent-3,364,366; US-Patent-Appl-SN-482952) Avail: US Patent Office CSCL 09E

Reported is a transistorized bootstrap sweep circuit having a capacitor which is charged linearly from a constant current source containing a first resistor. A plurality of threshold circuits are connected between the output terminal of the bootstrap circuit and a switching transistor. The collectors of each switching transistor are connected through a steering diode to the junction of the charging resistor and a diode. As the voltage across the charging capacitor, which also appears at the circuit output terminal, reaches a predetermined value, a threshold circuit set for the predetermined value causes its associated switching transistor to become conductive. As the output voltage continues to rise, the successive threshold circuits operate to again change the slope of the output voltage.
Official Gazette of the U.S. Patent Office

N71-29008* Bendix Corp., Ann Arbor, Mich. Aerospace System Div.
CIRCUIT BREAKER UTILIZING MAGNETIC LATCHING RELAYS Patent
Williard E. Reynolds and Henry W. Reinhold, inventors (to NASA) Issued 18 May 1971 4 p Filed 30 Oct. 1968 Cl. 317-33; Cl. 317-54; Cl. 317-80; Cl. 317-155.5; Int. Cl. H02h3/08 Sponsored by NASA
(NASA-Case-MSC-11277; US-Patent-3,579,041; US-Patent-Appl-NS-771759) Avail: US Patent Office CSCL 09E

A current switching main relay is described which is magnetically latched to provide a conductive and nonconductive path for the current device. The apparatus incorporates a magnetic latching relay which is responsive to overload currents and voltage sensing operations also. The second relay provides control signals for switching transistors which control the power relay. The transistors are biased normally off so that the total power consumption of the entirety of the circuit is limited to the power consumption of the current sensing coil.
Official Gazette of the U.S. Patent Office

N71-29017# Technical Univ. of Denmark, Lyngby. Lab. of Electromagnetic Theory.
INFLUENCE OF VARIATION OF BACKFIRE ANTENNA PARAMETERS. 2: SHORT-BACKFIRE ANTENNA
Erik Drago Nielsen 15 Oct. 1970 35 p refs
(Contract F61052-67-C-0056)
(AD-722048; R82; SR-3) Avail: NTIS CSCL 9/5

A large number of numerical and experimental results showing the influence of a variation of the antenna parameters on the radiation properties of a short-backfire antenna are presented. These results may be very useful for the design of such antennas. The numerical results were calculated on a digital computer using a previously published theory for backfire antennas with dipole elements. The experimental results were measured in a radio anechoic chamber. Other numerical results were obtained, which show that the radiation properties of the short-backfire antenna correspond to those of open resonators. Finally, a number of computations were carried out in order to investigate the possibility of applying the short-backfire antenna as the excitation system of a Yagi antenna. Author (GRA)

N71-29035* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CYCLIC SWITCH Patent
Alex Vary, inventor (to NASA) Issued 18 May 1971 5 p Filed 31 Dec. 1969 Cl. 337-114; Cl. 337-121; Int. Cl. H01h37/36; Int. Cl. H01h87/00
(NASA-Case-LEW-10155-1; US-Patent-3,579,168; US-Patent-Appl-SN-889387) Avail: US Patent Office CSCL 09A

A switch is described which utilizes a liquid metal in the cavity of a metal chamber connected in a conductor through which current flows from a dc source to a load or vice versa. Abrupt, cyclic decreases in current are effected by the formation of vapor films or vapor cavities which form at the interfaces between the liquid metal and the walls of the chamber due to ohmic heating. A source of pressurized gas communicates with the interior of the chamber. Cooling means for the chamber are provided to extract heat at a predetermined rate. The chamber may also be subjected to ultrasonic waves and heat waves to alter the wetting-dewetting action of the liquid metal. Official Gazette of the U.S. Patent Office

N71-29139* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DIGITAL PULSE WIDTH SELECTION CIRCUIT Patent
David F. Slowikowski, inventor (to NASA) Issued 18 May 1971 5 p Filed 7 Nov. 1969 Cl. 307-265; Cl. 307-215; Cl. 307-247; Cl. 307-273; Cl. 307-294; Cl. 328-207; Int. Cl. H03k1/18
(NASA-Case-XLA-07788; US-Patent-3,578,988; US-Patent-Appl-SN-874732) Avail: US Patent Office CSCL 09E

A device that will produce different width pulses. The width of the pulse produced at any given time is selected by a digital input. The digital input selects one of two or more possible timing circuits for a one-shot multivibrator. Hence, the digital input selects one of two or more possible pulse widths capable of being produced by the multivibrator. Official Gazette of the U.S. Patent Office

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

N71-28052# New York Univ., N.Y. Dept. of Electrical Engineering.
UNIFYING CONCEPTS OF SYSTEMS APPLICABLE TO AEROSPACE SYSTEMS Annual Report, 1 Nov. 1969 – 31 Oct. 1970
Anthony J. Grammaticos and John R. Ragazzini 1 Nov. 1970 18 p refs
(Grant AF-AFOSR-1393-68)
(AD-721461; TR-400-212; AFOSR-TR-71-0813) Avail: NTIS CSCL 12/1

The main areas of research which have been investigated during the third year of the Grant are optimal discrete-time self adaptive filters, optimal adaptive linear systems with unknown input gains, neutrality and separability, properties of dual control algorithms, the controllability of fixed linear systems, compatible suboptimal controllers for the constrained dynamic compensation of linear systems and multi-reflexive regulation of heart rate during lung inflation. In the case of discrete-time filters, a numerical algorithm was derived for calculating the output of the filter which adapts to its own noise. The derivation of the optimal control law for linear systems with unknown input gains is another new result of this research effort. Results of the investigation in dual control include the establishment of a separation property for certain problems of identification and control as well as the establishment of certain neutrality and separability properties of dual control algorithms. Considerable insight into the multi-reflex regulation of heart rate has been gained through extensive experimental work still in progress. A new controller design procedure for asymptotically optimal linear systems with one input has been established. This procedure shows definite advantages in comparison with known procedures which are based on the theory of observers. Author (GRA)

N71-28063# Royal Aircraft Establishment, Farnborough (England).
THE EFFECT OF ALTITUDE ON ARC LENGTH IN 200 VOLT ac AND dc SYSTEMS
R. F. Sims and R. L. A. McKenzie Nov. 1969 8 p
(RAE-TR-69259) Copyright. Avail: NTIS

The maximum length of a sustained arc was investigated for air pressures equivalent to altitudes of up to 95000 ft (29000 m) with 200 V ac and dc systems. With a dc supply the maximum length varied from 1/2 in (12.7 mm) at sea level to 8 in (203 mm) at 75000 ft (23000 m) or more. With an ac supply no sustained arcing occurred with any gap down to 1/16 in (1.6 mm) even at altitudes of up to 80000 ft. Author

N71-28075*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A METHOD FOR REDUCING THE SENSITIVITY OF OPTIMAL NONLINEAR SYSTEMS TO PARAMETER UNCERTAINTY
Jarrell R. Elliott and William F. Teague (Kansas Univ.) Washington Jun. 1971 41 p refs
(NASA-TN-D-6218; L-7485) Avail: NTIS CSCL 09C

Mathematical relationships are derived and used to establish a procedure for reshaping the optimal solution so as to reduce the statistical uncertainty in the terminal conditions of the system due to system parameter uncertainties of known statistical properties. The procedure introduces the use of an augmented performance index which contains a scalar measure of the system sensitivity partial derivatives. A nonlinear multiparameter optimal-rocket-trajectory problem was solved by using an algorithm based on the method of steepest descent to illustrate the procedure. Author

N71-28078# Ecole Nationale Superieure des Mines de Paris, Fontainebleau (France). Centre d'Automatique.
PRACTICAL SIMULATION OF RANDOM FUNCTIONS [SIMULATION PRATIQUE DE FONCTIONS ALEATOIRES]
J. Kryze Nov. 1970 17 p refs In FRENCH; ENGLISH summary
Presented at the Seminar on Stochastic Models, 26–27 Nov. 1970

(Contract F61052-70-C-0023)
(AD-721496; C/17-4; AFOSR-TR-71-0868) Avail: NTIS CSCL 12/1

Identification of single input-single output systems is achieved by minimizing the integral of the square of the deviation between model and system output, subject to same pseudo random input. The method is known to be effective if no unknown disturbance affects the system. If an uncorrelated additive noise corrupts the output, the identification is less accurate. The acheivable accuracy is a function of the signal to noise ratio and of the accuracy of the measurement of the criterion to be minimized. For small deviations, the sensitivity in parameter space is described accurately enough by a quadratic form. The effect of the errors in parameter identification on the response of the model is small, except in some frequency bands. In both deterministic and stochastic problems, the accuracy of the method could be significantly increased by the use of appropriate high pass or band pass filters. Author (GRA)

N71-28214# Toulouse Univ. (France). Faculte des Sciences.
CONTRIBUTION TO THE STUDY OF THE 1/F BACKGROUND NOISE IN SILICON TRANSISTORS [CONTRIBUTION A L'ETUDE DU BRUIT DE FOND EN 1/F DES TRANSISTORS AU SILICIUM]
Jean-Marie Ribeyrol (Ph.D. Thesis) Jul. 1969 130 p refs In FRENCH
Avail: NTIS

The 1/f noise in planar silicon bipolar transistor junctions was analyzed and an equivalent generator was designed. The influence of surface effects on the behavior of bipolar transistors is described and the site and mechanism of the noise generator are discussed. ESRO

N71-28349# Naval Postgraduate School, Monterey, Calif.
A LIMIT CYCLING SPEED CONTROL SYSTEM
Hasan Kocaoglu (M.S. Thesis) Dec. 1970 97 p refs
(AD-721561) Avail: NTIS CSCL 13/9

The concept of a limit cycling control in power supplies and speed control has advanced the application of these broad areas. On-off switching of a thyristor provides a simple and economical method of control and regulation. This switching of the thyristor causes the system to limit cicle. Basic analysis and design of speed control was performed. A describing function was developed to model the power-supply and rectifier bridge. Then it was used to predict the frequency and amplitude of the limit cycle. A digital computer program was used to simulate the system response and to construct the describing function curves. To verify the describing function validity, the limit cycle predictions were compared with the simulated results. Fourier analyses were performed to determine the ripple instability and subharmonic effect of the system output. Author (GRA)

N71-28415# Naval Postgraduate School, Monterey, Calif.
FAULT IDENTIFICATON MATRIX IN LINEAR NETWORKS
Kwang Ho Yim (M.S. Thesis) Sep. 1970 104 p refs
(AD-721581) Avail: NTIS CSCL 9/5

A method utilizing vector representation is investigated for determining a faulty element in passive and active networks by simple external measurements. A large system may be considered as an interconnection of a number of sub-networks. By utilizing the relationships between the magnitudes of a transfer function at various frequencies and the deviations of a circuit element, the fault simulation curves can be drawn. The fault identification regions are defined from the fault simulation curves. A fault identification matrix is constructed corresponding to the defined fault identification regions. The fault identification matrix, when premultiplied by a vector whose components are measured from a network, yields another vector whose components identify a network element which is faulty. A test procedure for the fault identification method is presented and verified. Author (GRA)

N71-28416# Army Electronics Command, Fort Monmouth, N.J.
QUARTZ CRYSTAL MEASUREMENTS
Erich Hafner, Arthur Ballato, and Paul Blomster Dec. 1970 26 p refs
(AD-721584; ECOM-3374) Avail: NTIS CSCL 9/1

The technique proposed by the IEEE Subcommittee on Crystal Measurements for Standard reference purposes are discussed in some detail, and the rationale that led to this selection presented. The paper includes an analysis of round robin results. Author (GRA)

N71-28612 Princeton Univ., N.J.
SUBOPTIMAL CONTROL OF NONLINEAR AND INEQUALITY CONSTRAINED CONTROL SYSTEMS
Allan P. J. Weber (Ph.D. Thesis) 1969 498 p
Avail: Univ. Microfilms Order No. 70-14247

Computational algorithms are discussed which were developed for the suboptimal feedback control of nonlinear constrained and unconstrained multidimensional systems with a quadratic performance index. Optimal feedback control of constrained linear systems is also detailed. Control problems were solved principally by converting them to unconstrained linear-quadratic problems. By dynamic programming, an analytic solution for feedback control of the linear-quadratic problem was derived. Conversion of the unconstrained nonlinear system to linear-quadratic form was carried out by means of a special technique of linearization. Reduction of the problem with constraints to a linear-quadratic control problem was accomplished by imbedding the constrained system into a larger unconstrained one, called the augmented system. The special linearization technique was used in constructing the augmented system when the constrained system was nonlinear. All constraints were imposed by a penalty function method. Dissert. Abstr.

N71-28626# Stanford Univ., Calif. Electronics Labs.
A TRANSFORM FOR NAND NETWORK DESIGN
Hsiao-Peng Lee and Edward S. Davidson Jan. 1971 46 p refs
(Contract N00014-67-A-0112-0044; Grant NSF GK-4852)
(AD-720328; SU-SEL-70-059; TR-10) Avail: NTIS CSCL 9/2

A transform which operates on the interconnection topology of a NAND network is presented. The output connecting a designated gate to the network is deleted and is connected instead to a number of other gates in the network. The entire transform may be specified by designating a transformed gate and a modified gate. The new connections are made and the resulting network is then simplified logically by casting out redundancy and merging gates in the network. Author (GRA)

N71-28675 Wisconsin Univ., Madison.
NEW NECESSARY AND SUFFICIENT CONDITIONS FOR IMPEDANCE MATRIX SYNTHESIS
Arnold Ying-Ho Lee (Ph.D. Thesis) 1969 174 p
Avail: Univ. Microfilms Order No. 70-3603

Determination of necessary and sufficient conditions for the synthesis of open circuit impedance matrices and investigation of the topological properties of the corresponding graphs are studied. Three different areas of network synthesis are involved: (1) impedance matrix synthesis of star-port networks, (2) impedance matrix synthesis of graphs of nullity N, and (3) impedance matrix synthesis of graphs of nullity greater than N. New sufficient conditions for realizing some special classes of open circuit impedance matrices are obtained. Some new necessary conditions for determining the existence of certain topological structures of the port-edges are established. Dissert. Abstr.

N71-28882# Princeton Univ., N.J. Dept. of Electrical Engineering.
ON THE APPLICATIONS OF RANDOM SIGNALS WITH MULTIPLICITY ONE Scientific Interim Report
Anthony Ephremides and John B. Thomas Feb. 1971 12 p

refs Presented at the 8th Ann. Allerton Conf. on Circuit and System Theory, 7–9 Oct. 1970 Submitted for publication
(Grant AF-AFOSR-1333-67)
(AD-721451; AFOSR-TR-71-0838) Avail: NTIS CSCL 9/4

In a number of applications of random signal theory, it is necessary to consider random processes with multiplicity one. Such processes possess the property that they may be prewhitened by a linear, causal, invertible filter. After presenting some background on the notion of multiplicity, this paper considers two important applications: (1) The modeling of stochastic signals by linear systems, and (2) the prewhitening approach to linear least-mean-square estimation. Author (GRA)

N71-28692 Wisconsin Univ., Madison.
THE IDENTIFICATION AND CONTROL OF HYBERBOLIC DISTRIBUTED PROCESSES
Richard Harry Thomas (Ph.D. Thesis) 1970 225 p
Avail: Univ. Microfilms Order No. 70-8337

An identification strategy which eliminates the necessity for explicitly solving partial differential hyperbolic process models prior to optimal control policy implementation is developed. The identification strategy utilizes synthesized biorthogonal function sets and biorthogonal filtering to generate the required process controller parameters. Augmented with a state measurement procedure, the identification strategy is incorporated in a proposed closed-loop adaptive controller. The controller is essentially speed independent and can be implemented with a general purpose digital computer. Properties of discrete space-continuous time differential difference hyperbolic process models are discussed; the influence of model precision on the apparent minimum control period is considered along with a criterion for selecting boundary equations and performing energy scaling. Hybrid computer studies demonstrated that optimal biorthogonal controllers are most sensitive to perturbations in eigenfrequencies. Simulation experiments also revealed that velocity and maximum effort control strategies yield near optimal performance of low-order mode excitation. Dissert. Abstr.

N71-28693 Michigan Univ., Ann Arbor.
DESIGN CRITERIA FOR NONLINEAR FEEDBACK SYSTEMS
Herbert Charles Towle (Ph.D. Thesis) 1969 146 p
Avail: Univ. Microfilms Order No. 70-14664

Criteria are defined which are sufficient to establish upper bounds for the error of relatively simple output solutions for a class of nonlinear feedback systems. The systems considered are of the Lur'e form for direct control with a sinusoidal input. The solutions are the single frequency approximation obtained by using a describing function for the nonlinearity and the multifrequency first order improvement to this solution obtained by use of a contraction mapping. The nonlinear element considered is the saturation function which may be used to approximate the operating characteristics of many physical systems. The linear system element is considered in both a general case with few restrictions and also when limited to a standard second order form. In the latter case, error bounds are presented for solutions covering a range of system design parameters. An example of a more general case is illustrated by consideration of the solution error bound for a speed control system applied to a paper machine section. Dissert. Abstr.

N71-28739* Radio Corp. of America, New York.
TRANSIENT AUGMENTATION CIRCUIT FOR PULSE AMPLIFIERS Patent
Richard D. Benedict, inventor (to NASA) Issued 6 Sep. 1966 3 p Filed 16 Jun. 1964 Cl. 307-88.5 Sponsored by NASA
(NASA-Case-XNP-01068; US-Patent-2,271,594;
US-Patent-Appl-SN-375680) Avail: US Patent Office CSCL 09E

Digital data handling circuits for augmenting the transient negative current capabilities of pulse power amplifier are discussed. The circuits are used for restoring degraded pulse data and supplying the required load current in high speed digital switching circuits. The advantages of the circuits over previous systems are also discussed. E.H.W.

N71-28767 Princeton Univ., N.J.
AN INVESTIGATION OF THE NOISE MARGIN OF DIGITAL CIRCUITS
Paul John Krick (Ph.D. Thesis) 1969 96 p
Avail: Univ. Microfilms Order No. 70-14221

The static noise margin of digital networks was characterized by determining the single-source static noise margin and the worst-case static noise margin which correspond to the most optimistic and conservative noise margins respectively, in terms of the number and arrangement of noise sources in a network. A systematic study of the propagation of time-limited signals in digital networks has shown that there is no inherent physical distinction between time-limited noise signals and time-limited logic signals in a digital network. Therefore the transient noise margin of digital networks is defined subjectively utilizing the dynamic switching threshold of memory elements. The transient noise margin of networks of identical gates which exhibit memory is derived from the transient noise margin of the shortest possible stable loop of gates, i.e., a pair of cross-coupled gates. Dissert. Abstr.

N71-28783* Minneapolis-Honeywell Regulator Co., Minn.
MICROELECTRONIC MODULE PACKAGE Patent
Albert L. Johnson, Jr., inventor (to NASA) Issued 2 May 1967 3 p Filed 23 Dec. 1965 Cl. 317-100 Sponsored by NASA
(NASA-Case-XMS-02182; US-Patent-3,317,797;
US-Patent-Appl-SN-516153) Avail: US Patent Office CSCL 09E

Designs for overcoming shock and vibration problems in microelectronic module packages are discussed. The module package comprises a metal heat sink which forms a rigid mechanical support with good thermal dissipation properties. Descriptions are also given of the electric connections for thin film hybrid microcircuits in such a package. E.H.W.

N71-28805 Virginia Polytechnic Inst., Blacksburg.
NONLINEAR BEHAVIOR (ANALYSIS AND SIMULATION) OF SEVERAL SECOND ORDER RANDOM-MODULATED PHASE-LOCKED LOOPS
Charles Martin Lindauer (Ph.D. Thesis) 1970 115 p
Avail: Univ. Microfilms Order No. 70-13689

An analysis and a digital simulation are performed upon a phase-locked loop, whose input signal is frequency modulated by a nonwhite normally distributed waveform. The two specific loops under consideration are the RC case and the perfect integrator case. The nonlinear system equations for both cases are of third order type and may thus be written in state variable format where the state vectors in each case are three-dimensional. If the modulating signal is preceded by a whitening filter, then an auxiliary signal, whose spectrum is white, would appear at the input of this filter as an equivalent driving function. The entire vector system, thus modified, may be considered as a Markov process, and the joint probability function of the corresponding state vector is amenable to solution by Fokker-Planck techniques. For each of the two systems, steady state Fokker-Planck equations are set up, and the phase error boundary values are reduced to modulo 2 pi. Dissert. Abstr.

N71-28824 Michigan Univ., Ann Arbor.
ITERATIVE SYNTHESIS OF TEM MODE DISTRIBUTED NETWORKS
Solaimanul Mahdi (Ph.D. Thesis) 1969 197 p
Avail: Univ. Microfilms Order No. 70-14587

An iterative, digital computer algorithm was developed which achieved a dominant pole synthesis. The procedure is detailed for a transverse electromagnetic mode structure of alternating open stubs and connecting lines. The method uses a Newton-Raphson iterative scheme to adjust the characteristic impedances and

lengths of the transmission lines for a prescribed set of dominant transmission lines for a prescribed set of dominant transmission poles. By controlling the stub line lengths; the dominant pole positions, the principal transmission zeros, and bounded characteristic impedances can be achieved simultaneously. The occurrence of nondominant poles was analytically investigated. A nonlinear programming problem was formulated, and a method for its solution is presented, which aligns j omega-axis transmission zeros opposite the nondominant transmission poles in or near the stopband.
Dissert. Abstr.

N71-28825 California Univ., Los Angeles.
THE APPLICATION OF A THEORETICAL LEARNING MODEL TO REMOTE MANIPULATOR CONTROL
Amos Freedy (Ph.D. Thesis) 1969 164 p
Avail: Univ. Microfilms Order No. 70-14281

The concept of adaptive aiding as a means of improving performance in remote handling is discussed, the development, realization and experimental evaluation of a system based on this concept is described. Initially, the manipulator is totally controlled by the operator, while the automaton acts as a passive observer. As operation continues behavior patterns are acquired by the automaton and gradually it is transformed from a passive observer to an active controller. This reduces the operator's function to that of an initiator and inhibitor of machine actions. The adaptive features of the automaton provide it with the ability to change behavioral patterns in response to variations in the environment and in the task. A learning model based on maximum likelihood principles constitutes the mathematical basis for the automaton. It was programmed on an IBM 1800 process control computer and was interfaced to the manipulator through a small analog computer.
Dissert. Abstr.

N71-28826 Illinois Univ., Urbana.
RANDOM INPUT SIGNAL ANALYSIS OF NONLINEAR SYSTEMS WITH TRANSPORT DELAY
John Peterson Gordon (Ph.D. Thesis) 1969 61 p
Avail: Univ. Microfilms Order No. 70-13326

A method based on cross correlation of input and output signals of a system excited by a pseudo-random input signal was used to determine the effect of nonlinearities and transport delay on the impulse response of the system. Zero-memory, single-valued nonlinearities of the saturation and stiction type in the forward path of a feedback control system were investigated in conjunction with transport delay in the feedback path. The nonlinearities were described by piecewise-linear representations. The pseudo-random input signal used was of the Gaussian or multi-level type. The system was represented by a second-order, nonlinear differential-difference equation. Using piecewise linear representations reduced the problem to solving three linear differential-difference equations. The problem was programmed for solution by a digital computer using the standard fourth-order Runge Kutta method. Dissert. Abstr.

N71-28859* Space Technology Labs., Inc., Redondo Beach, Calif.
COMPENSATING BANDWIDTH SWITCHING TRANSIENTS IN AN AMPLIFIER CIRCUIT Patent
La Rue A. Hoffman, inventor (to NASA) Issued 18 Jun. 1968 4 p Filed 20 Jul. 1964 Cl. 330-51 Sponsored by NASA
(NASA-Case-XNP-01107; US-Patent-3,389,346;
US-Patent-Appl-SN-384010) Avail: US Patent Office CSCL 09C

A bandwidth switching arrangement for an operational amplifier filter is described, which includes a resistive capacitive feedback network, formed by a first capacitor and resistor between the input and output terminals thereof. The arrangement includes a second capacitor and a multicontact relay used, in one state, to connect the second capacitor through a resistor to ground so that the voltage across the second capacitor is substantially equal to the voltage across the first capacitor in the feedback loop. Then, when the relay is switched to a second state, the second capacitor is connected by means of the relay contacts, in parallel across the first capacitor to increase the feedback capacitance and thereby reduce the bandwidth. Official Gazette of the U.S. Patent Office

N71-28860* Lockheed Electronics Co., Houston, Tex.
MONOSTABLE MULTIVIBRATOR WITH COMPLEMENTARY NOR GATES Patent
Robert W. O'Neill, inventor (to NASA) Issued 4 May 1971 4 p Filed 8 Jul. 1970 Cl. 307-273; Cl. 307-215; Cl. 307-265; Cl. 328-92; Cl- 328-207; Int. Cl. H03k3/26; Int. Cl. H03k18/34 Sponsored by NASA
(NASA-Case-MSC-13492-1; US-Patent-3,577,014;
US-Patent-Appl-SN-53156) Avail: US Patent Office CSCL 09C

First and second positive NOR complementary Mos gates are employed to form a monostable multivibrator circuit in which the output of the first gate forms the input to the second gate and the output of the second gate forms the system output. The trigger signal supplied to the gates is differentiated through a resistance capacitance circuit and supplied to the first gate. The differentiated signal may be bypassed across the first gate through a semiconductor diode to the input of the second gate to permit narrow pulse width outputs to reduce input pulse power and to increase the duty cycle of the circuit. A feedback capacitor connected across both gates is employed in an internal resistance capacitance circuit to provide the time constant for the multivibrator.
Official Gazette of the U.S. Patent Office

N71-28960* Beckman Instruments, Inc., Fullerton, Calif.
PULSE GENERATING CIRCUIT EMPLOYING SWITCH MEANS ON ENDS OF DELAY LINE FOR ALTERNATELY CHARGING AND DISCHARGING SAME Patent
Fausto V. Taddeo, inventor (to NASA) Issued 17 May 1966 5 p Filed 7 Oct. 1963 Cl. 328-67 Sponsored by NASA
(NASA-Case-XNP-00745; US-Patent-3,252,100;
US-Patent-Appl-SN-314570) Avail: US Patent Office CSCL 09E

An improved pulse generator which is capable of operation at very high duty cycles and repetition rates approaching the theoretical maximums of 50 percent and one half the reciprocal of the pulse width, respectively, is provided. The generator, at the same time, possesses pulse width stability irrespective of shifts in operating conditions, such as substantial variations in amplitude and repetition rates of the trigger pulses, equipment aging, changes in environmental conditions, supply voltage variations, and the like.
Official Gazette of the U.S. Patent Office

N71-29135* International Business Machines Corp., New York.
REDUNDANT MEMORY ORGANIZATION Patent
Albert W. Vinal, inventor (to NASA) Issued 17 Oct. 1967 10 p Filed 3 Jul. 1963 Cl. 340-174 Sponsored by NASA
(NASA-Case-GSC-10564; US-Patent-3,348,218;
US-Patent-Appl-SN-292596) Avail: US Patent Office CSCL 09B

A redundant magnetic memory organization having redundant classes of elements as magnetic core elements, driver, sensing and inhibit circuitry is described. The memory organization has four redundant memory arrays which are interlinked by the driver, sensing and inhibit windings such that a correct output is provided as long as one magnetic core of a redundant set together with its associated driver, sensing and inhibit circuitry has not failed.
Official Gazette of the U.S. Patent Office

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N71-28130*# General Applied Science Labs., Inc., Westbury, N.Y.
MIXING CHAMBER DESIGN STUDY
F. W. Lipfert, ed. Mar. 1971 165 p refs
(Contract NAS2-5708)
(NASA-CR-114286; GASL-TR-751) Avail: NTIS CSCL 14B

The design concepts and experimental verification of the critical component for a unique aerothermo test facility are described. This component is a mixing chamber, which, in order to allow a wide range of wind tunnel operating conditions, from high Reynolds number supersonic flow to true temperature hypersonic flow, provides for mixing of three separate air streams: arc jet, storage heater air (1000 R < T < 4460 R), and cold air. This mixing chamber project entailed the following major tasks: (1) Theoretical predictions of mixing characteristics in order to find the best injection configurations and initial velocity levels. Calculations were made for both frozen and equilibrium flows. (2) A scaled test program to verify the actual mixing characteristics over a limited range of conditions. Two test programs were conducted; one with heated helium to simulate the high enthalpy jet, and one using a 4 mw arc jet. (3) Design of the mixing chamber and ancillary hardware which were required for coupling to the arc jet and air heater. (4) Systems operation, design, and analysis to insure proper and safe operation of the facility in all of its various modes. Author

N71-28175# Naval Research Lab., Washington, D.C. Nuclear Physics Div.
NRL VAN DE GRAAFF OPERATION Interim Report, 1 Jul.–31 Dec. 1970
K. L. Dunning, ed. Feb. 1971 33 p
(AD-721329; NRL-MR-2227) Avail: NTIS CSCL 20/7

The report is the 6th in a series of semiannual summaries on the use of the 5-MV Van de Graaff and associated instruments. The period 1 July to 31 December is covered. A brief statistical summary is presented; a few important developments concerning the maintenance and improvement of the facilities are discussed; brief accounts of on-giong and recently completed research projects are given. Author (GRA)

N71-28232*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FIXED-BASE SIMULATOR INVESTIGATION OF LIGHTWEIGHT VEHICLES FOR LUNAR ESCAPE TO ORBIT WITH KINESTHETIC ATTITUDE CONTROL AND SIMPLIFIED MANUAL GUIDANCE
David B. Middleton and George J. Hurt, Jr. Washington Jun. 1971 39 p refs
(NASA-TN-D-6299; L-7508) Avail: NTIS CSCL 22A

A piloted simulator investigation of the feasibility of using a class of very simplified and lightweight vehicles for emergency escape from the lunar surface has been made. The escape to orbit vehicles accommodate two men, but one man performs all the manual guidance and control functions. Kinesthetic control of pitch and roll was used successfully over a moment of inertia range of 340 to 1750 kg-m(2) (250 to 1290 slug-sq ft) for the vehicle (including men). The pilots were also able to cope with such off-nominal conditions as misalined thrust, uneven propellant drain, and thrust deficiency. About 5 percent of the runs were made with the pilot wearing a full pressure suit. Author

N71-28304# Joint Publications Research Service, Washington, D.C.
EQUIPMENT OF LABORATORY AND INDUSTRIAL FACILITIES
In its Methods of Producing Superpure Inorg. Substances 1 Jun. 1971 p 456–480 refs (See N71-28290 16-06)
Avail: NTIS HC $6.00/MF $0.95

The facilities and equipment needed for the production of superpure inorganic materials are described. Subjects discussed are: (1) location of buildings and installations, (2) design of facilities, (3) services and utilities, (4) distribution of electricity, and (5) special clothing to be worn by personnel. P.N.F.

N71-28422# Naval Civil Engineering Lab., Port Hueneme, Calif.
AIRFIELD PAVEMENT CONDITION SURVEY, USNAS CECIL FIELD, FLORIDA
D. J. Lambiotte and R. B. Brownie Mar. 1971 95 p
(AD-721325; NCEL-TN-1155) Avail: NTIS CSCL 1/5

The results of a condition survey of the airfield pavement at the U. S. Naval Air Station, Cecil Field, Florida are presented. The survey established statistically-based condition numbers (weighted defect densities) which were direct indicators of the condition of the individual asphaltic concrete and portland cement concrete pavement facilities. Additional evaluation efforts included photographic coverage of defect types, preparation of the construction history of the station, compilation of data on current aircraft traffic and aircraft types using the station, performance of runway skid resistance tests, and a study of the requirements for future pavement evaluation efforts. Author (GRA)

N71-28423# Naval Civil Engineering Lab., Port Hueneme, Calif.
AIRFIELD PAVEMENT CONDITION SURVEY, USNAS WILLOW GROVE, PENNSYLVANIA
D. J. Lambiotte and L. J. Woloszynski Feb. 1971 77 p
(AD-721324; NCEL-TN-1153) Avail: NTIS CSCL 1/5

The results of a condition survey of the airfield pavements at the U. S. Naval Air Station, Willow Grove, Pennsylvania are presented. The survey established statistically-based condition numbers (weighted defect densities) which were direct indicators of the condition of individual asphaltic concrete and portland cement concrete pavement facilities. Additional evaluation efforts included photographic coverage of defect types, preparation of the construction history of the station pavements, compilation of data on current aircraft traffic and aircraft types using the station, and a study of the requirements for future pavement evaluation efforts. Author (GRA)

N71-28424# Naval Civil Engineering Lab., Port Hueneme, Calif.
AIRFIELD PAVEMENT CONDITION SURVEY, USNALF CHARLESTOWN, RHODE ISLAND
D. J. Lambiotte and L. J. Woloszynski Feb. 1971 71 p
(AD-721323; NCEL-TN-1152) Avail: NTIS CSCL 1/5

The results of a condition survey of the airfield pavements at the USNALF Charlestown, Rhode Island, are presented. The survey established statistically-based condition numbers (weighted defect densities) which were direct indicators of the condition of the individual asphaltic concrete pavement facilities. Additional evaluation efforts included photographic coverage of defect types, preparation of the construction history of the station, compilation of data on current aircraft traffic and aircraft types using the station, performance of runway skid resistance tests, and a study of the requirements for future pavement evaluation efforts. Author (GRA)

N71-28617# Institute of Nuclear Research, Warsaw (Poland).
10 MeV PROTON LINEAR ACCELERATOR AT SWIERK
E. Dzyura, V. Grabovski, Yu. Yanushevski et al. 1970 13 p refs In RUSSIAN; ENGLISH summary
(INR-P-1218) Avail: AEC Depository Libraries

The main technical data of the 9.7 MeV proton linear accelerator built in the I.N.R. at Swierk are given. The modifications introduced to the Martini–Warner program for numerical calculation of electromagnetic field and resonant frequencies of resonators are mentioned. The basic troubles of the start-up period of the accelerator are described. Author (NSA)

N71-28629* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.

AUTOIGNITION TEST CELL Patent
Fred D. Evans, Carlos L. Springfield, and Coleman J. Bryan, inventors (to NASA) Issued 18 May 1971 4 p Filed 30 Jul. 1969 Cl. 73-15; Cl. 73-432; Int. Cl. G01n25/00
(NASA-Case-KSC-10198; US-Patent-3,578,756; US-Patent-Appl-SN-845971) Avail: US Patent Office CSCL 14B

A chamber is described for determining the decomposition and autoignition temperatures of materials used in spacecraft under controlled environmental conditions. It is an elongated hermetically sealed cylinder with couplings for a vacuum pump, gas source, mercury bubbler system, control valves, and other equipment. It is also provided with a viewing port and a thermocoupled probe for temperature measurements.
Official Gazette of the U.S. Patent Office

N71-28779* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
WIND TUNNEL MICROPHONE STRUCTURE Patent
William S. Chen and Samuel Wheeler, inventors (to NASA) Issued 12 Jul. 1966 4 p Filed 25 Jul. 1962 Cl. 181-.5 Sponsored by NASA
(NASA-Case-XNP-00250; US-Patent-3,260,326; US-Patent-Appl-SN-212497) Avail: US Patent Office CSCL 14B

A microphone apparatus for measuring sound and pressure in an acoustical environment, such as a wind tunnel, is discussed. The system is designed to minimize the effects of vibrations which are transmitted to the microphone, to minimize the effects of unwanted signals, and to measure the random fluctuating loads on a solid surface which are created by airflow past the surface.
P.N.F.

N71-28782# Atomic Energy Commission, Oak Ridge, Tenn. Div. of Technical Information Extension.
NUCLEAR REACTORS BUILT, BEING BUILT, OR PLANNED IN THE UNITED STATES AS OF 31 DECEMBER 1970
1970 36 p Revised
(TID-8200-Rev-23) Avail: NTIS

Information about facilities in the U. S. capable of sustaining a nuclear chain reaction is tabulated. The name of the facility is listed with location, principal nuclear contractor, type, power, and startup date. The facilities are categorized as: civilian reactors, production reactors, military reactors, reactors for export, and critical assemblies.
NSA

N71-28802*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE NASA LRC FAINT METEOR SPECTRA PATROL
Gale A. Harvey Washington Jul. 1971 27 p refs
(NASA-TN-D-6298; L-7663) Avail: NTIS CSCL 14B

A description of the instrumentation, facilities, and patrol technique used by the NASA LRC Faint Meteor Spectra Patrol is given. The primary purpose of the patrol is to provide data for composition and mass analysis of meteoroids in the 1-milligram to 1-gram mass range. The spectral data are also used for study of faint meteor radiation processes. The primary spectrographs are 15-cm-aperture, f/1.3 Maksutov slitless spectrographs with fused silica transmission elements. A photoelectric meteor detection shutter system is used with the spectrographs. A list of the 319 meteor spectra obtained in the first 2 years of operation is included, and four representative types of spectra obtained by the patrol are briefly described.
Author

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N71-28014*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A SIMPLE INTEGRAL METHOD FOR THE CALCULATION OF REAL-GAS TURBULENT BOUNDARY LAYERS WITH VARIABLE EDGE ENTROPY
Charles B. Johnson and Lillian R. Boney Washington Jun. 1971 46 p refs
(NASA-TN-D-6217; L-7415) Avail: NTIS CSCL 20D

An integral method for computing the turbulent boundary layer is presented. The method includes the effect of equilibrium air chemistry and variable edge entropy. A modified Crocco enthalpy velocity relationship is used for the enthalpy profiles and and empirical correlation of the N-power law profile is used for the velocity profile. The skin friction coefficient expressions of Spalding and Chi and Van Driest are used in the solution of the momentum equation and in the heat transfer predictions that use several modified forms of Reynolds analogy. Heat transfer data measured in ground tests on a flat plate at a Mach number of 6.0 and on blunt cones at Mach numbers of 8.0 and 11.5 are in good agreement with predictions based on the present method. Sample calculations showing the effect of variable entropy and nose bluntness are presented for flight calculations at approximately 6.09 km/sec (20,000 ft/sec).
Author

N71-28015# Illinois Univ., Urbana. Dept. of Aeronautical and Astronautical Engineering.
DETONATION MACH STEMS Final Scientific Report
Roger A. Strehlow and Harold O. Barthel Jan. 1971 93 p refs
(Grant AF-AFOSR-1585-68)
(AD-721465; AAE-71-1; AFOSR-70-2936TR) Avail: NTIS CSCL 19D

A quantitative comparison of reactive and nonreactive Mach stems was made. It was found that the triple point structure is unaffected by the presence of reaction but that the trajectory of the Mach stem is slightly affected by the presence of reaction. The implications of these observations to an understanding of detonations structure is discussed.
Author (GRA)

N71-28104*# Santa Clara Univ., Calif. School of Engineering.
APPLICABILITY OF FLUIDIC CONTROLS TO A RANKINE CYCLE AUTOMOTIVE ENGINE Final Report
R. Ian Murray, Stein Weissenberger, and Eugene J. Fisher Dec. 1970 52 p
(Grant NGR-05-017-023)
(NASA-CR-119006) Avail: NTIS CSCL 13G

Rankine cycle performance with three different fluids is evaluated: water, CP-34, and freon TF. Performance with CP-34 and a reciprocating expander using fluidic flow diverters instead of mechanical valves is examined. The control criteria for the boiler and feed pump are also investigated. It is concluded that the use of fluidic flow diverters in place of mechanical valves is not feasible and that any further effort to apply fluidic controls to automotive engines should be in information sensing and processing rather than in direct control of power.
Author

N71-28178# Naval Postgraduate School, Monterey, Calif.
FLOW OF DILUTE POLYMER SOLUTIONS ABOUT CIRCULAR CYLINDERS
Turgut Sarpkaya and P. G. Rainey Feb. 1971 147 p refs
(AD-722007; NPS-59SL1021A) Avail: NTIS CSCL 20/4

Flow of aqueous solutions of Polyox WSR-301, with concentrations of 1.0 to 200 wppm, past circular cylinders was investigated in the drag-transition region of Reynolds numbers. Drag force, pressure distribution, and separation angle were measured on cylinders with diameters from 1/4 to 1-1/2 inch. Lift and drag forces acting on a NACA-0024 hydrofoil-model were also measured. The polymer additive was found to alter only those force coefficients which have a Reynolds-number transition region. Two distinct types of cylinder drag transition were observed: (1) At high

concentrations, transition from sub-critical to a transcritical flow occurred at the same free-stream velocity independent of body diameter; and (2) at low concentrations and/or molecular weights, tripping from a sub-critical to a super-critical flow occurred at a well defined flow condition which was a function of free-stream velocity, body diameter, and turbulent pipe-flow friction reduction. In all cases, transition occurred earlier than that in the pure solvent. The polymer had a de-stabilizing effect on the boundary-layer flow.
Author (GRA)

N71-28235# Technische Hogeschool, Delft (Netherlands). Afdeling der Technische Natuurkunde.
DROPS: FORMATION AND MASS TRANSFER [DRUPPELS: VORMING EN STOFOVERDRACHT]
Leendert Hendrik De Nie (Ph.D. Thesis) 1969 155 p refs In DUTCH; ENGLISH summary
Avail: NTIS

The mechanism of mass transfer inside liquid drops during formation and coalescence in a second immiscible liquid phase is investigated. The study is retricted to drops formed at non-wetted capillaries, using the isobutanol-water binary system which has a stable interface.
ESRO

N71-28270*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CORRELATION OF SECONDARY SONIC AND SUPERSONIC GASEOUS JET PENETRATION INTO SUPERSONIC CROSSFLOWS
Frederick P. Povinelli and Louis A. Povinelli Washington Jun. 1971 21 p refs
(NASA-TN-D-6370; E-6128) Avail: NTIS CSCL 20D

Helium was injected from a flat plate normal to Mach 2 and Mach 3 airstreams at various injection Mach numbers ranging from sonic to Mach 4. Concentration measurements were taken downstream of the secondary injection location for a range of injection and tunnel total pressures. Supersonic injection resulted in as much as a 30 percent increase in penetration over that obtained for equal mass flow sonic injection. An equation based on jet Mach number, pressure ratio between the jet and free stream, and downstream distance was obtained which correlated the data to within + or - 10 percent. Penetration data from four other studies were compared with the present data and were correlated when the boundary layer momentum loss was considered.
Author

N71-28271*# Maryland Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics.
THE STABILIZING EFFECT OF BOUNDARIES ON THERMAL CONVECTION
Kenneth S. Gage Mar. 1971 30 p refs Presented at the 23d Ann. Meeting, Div. of Fluid Dyn., Am. Phys. Soc., Charlottesville, Va., 23-25 Nov. 1970
(Grants NGL-21-002-008; NSF GZ-761)
(NASA-CR-119015; BN-686) Avail: NTIS CSCL 20D

The classical theory for Benard Convection of a viscous, incompressible fluid layer confined between horizontal surfaces is generalized to semibounded and unbounded fluids. Two and three layer models are solved numerically to give curves of neutral stability in the Raleigh number wavenumber plane. For each model a family of neutral curves is given which is parameterized by the static stability of adjacent layers of fluid. The results demonstrate a destabilization of the classical problem which is most pronounced at small wavenumbers when the static stability of adjacent layers is neutral.
Author

N71-28321*# Maryland Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics.
A MATHEMATICAL MODEL FOR INVESTIGATING THE STABILITY OF THERMALLY STRATIFIED FLOW OF UNBOUNDED VISCOUS INCOMPRESSIBLE FLUID
K. S. Gage Mar. 1971 41 p refs
(Grant NGL-21-002-008; Contract AT(30-1)-4199)
(NASA-CR-119026; BN-679) Avail: NTIS CSCL 20D

The characteristic value problem for discontinuous jet and shear layers is investigated. In order to find these characteristic values, an eigenvalue search routine is employed and curves of neutral stability for the shear layer and jet are found for several values of the Richardson number. A Prandtl number dependence was found for the eigenvalues of the shear layer even in the absence of thermal stratification. The stabilizing effect of the thermal stratification as parameterized by the Richardson number was found to be most stabilizing for small wavenumber (large-scale) disturbances. Moreover, since the model employing discontinuous profiles can only be used to infer the small wavenumber stability characteristics of continuous flows, no conclusions are drawn concerning a critical Richardson number which stabilizes the continuous flows.
Author

N71-28403*# United Aircraft Corp., East Hartford, Conn.
EXPERIMENTAL STUDY OF ONE- AND TWO-COMPONENT LOW-TURBULENCE CONFINED COAXIAL FLOWS
John C. Bennett and Bruce V. Johnson Washington NASA Jun. 1971 87 p refs
(Contract NAS3-13459)
(NASA-CR-1851; J-910934-10) Avail: NTIS CSCL 20D

Fluid mechanics experiments were performed to investigate methods for reducing the mixing between confined coaxial flows in cylindrical chambers for application to open-cycle gaseous-core nuclear rockets. Velocity profiles, inner-jet partial pressure profiles, and flow visualization were obtained and analyzed to determine the effect of outer-stream to inner-jet weight-flow ratio on inner-jet containment. The weight-flow ratio for which the inner-jet gas filled 20 percent of the chamber volume was increased by factors of 10 and 2.7 for tests with air and Freon-11, compared to the previous results.
Author

N71-28426# Boeing Scientific Research Labs., Seattle, Wash.
COMPUTATIONAL METHODS FOR INVISCID TRANSONIC FLOWS WITH IMBEDDED SHOCK WAVES
Earll M. Murman Feb. 1971 72 p refs
(AD-721933; D1-82-1053) Avail: NTIS CSCL 20/4

A discussion is given of the methods for computing transonic flows with imbedded shock waves. Time dependent techniques, relaxation methods and approximate solutions are considered with emphasis placed on the latest developments. More details are given on the relaxation methods than other techniques. Computing times, accuracy, and proper treatment of shock waves are stressed.
Author (GRA)

N71-28614# Lockheed Missiles and Space Co., Sunnyvale, Calif.
AN EXPERIMENTAL STUDY OF THE EFFECTS OF WAVES ON THE VENTILATION OF SURFACE-PIERCING STRUTS Final Report, Nov. 1968 - Oct. 1970
Ray L. Kramer Nov. 1970 51 p refs
(Contract N00014-70-C-0098)
(AD-721375; LMSC-D029878) Avail: NTIS CSCL 20/4

An experimental program was conducted to investigate the effects of waves on ventilation inception for two surface-piercing strut models of one-foot chord length. The majority of tests were conducted with a strut model of leading edge radius equal to 1.82 percent of the chord length. Tests were performed in head and following waves and at 8 and 10 degrees yaw. Low ambient pressures were utilized to obtain ventilation inception in the presence of cavitation in the Froude number range 2.5 to 5. Exploratory tests were also conducted with a strut model with a sharp leading edge. The effects on ventilation inception under the various wave conditions were compared on the basis of cavitation number

required for ventilation inception. For the blunt-leading-edge strut at a Froude number of 3.2, the cavitation number was increased by a factor of up to two for ventilation in waves. The magnitude of the wave influence decreased as the Froude number was increased until at a Froude number of 5 a factor of up to 1.3 was obtained. For the sharp-leading-edge strut, ventilation inception occurred at greatly increased cavitation numbers of five to ten time those for calm water. Author (GRA)

N71-28627# Columbia Research Corp., Gaithersburg, Md.
EVALUATION OF FRICTION REDUCING ADDITIVES FOR PIPELINE USE Final Technical Report, 28 Jun. 1968 – 28 Jun. 1970
Patrick A. Crowley and Norman C. Witbeck Oct. 1970 47 p refs
(Contract DAAK02-68-C-0589)
(AD-722262; TR-101-F) Avail: NTIS CSCL 20/4

A large number of additives were checked for friction reducing ability in a turbulently flowing petroleum based fluid. Several pipelines of various lengths and diameters were used and the efficiency of effective additives was measured as a function of concentration. By subjecting the additives to a sever-shear environment, an estimate of the degradation characteristics was obtained. The most promising materials appear to be high molecular weight polymers, particularly polyisobutylene and polydimethylsiloxane. In the course of the present effort, it was demonstrated that these additives are effective in pipelines of the size and with the flow velocity of commercial and military pipelines and under conditions not detrimental to the fuel usage or equipment can enhance the flow rate by as much as 50%. Author (GRA)

N71-28628 Florida Univ., Gainesville.
ON LIAPUNOV'S DIRECT METHOD: A UNIFIED APPROACH TO HYDRODYNAMIC STABILITY THEORY
John Paul San Giovanni (Ph. D. Thesis) 1969 293 p
Avail: Univ. Microfilms Order No. 70-11755

A unified approach to stability problems for systems described by operator equations of evolution, and the direct method of Liapunov are studied. The formalism is illustrated by considering a subclass of physical systems for which the describing equations are the balance of mass and linear momentum and for which the state is specified by the velocity field. Relevant stability analysis equations for the entire class of parallel flows are developed for constitutive operators with particular mathematical characteristics, and then for several classes of ideal materials. Stability equations pertinent to any particular parallel flow are precipitated from these by the specification of a coordinate system and the components of the basic velocity field. Dissert. Abstr.

N71-28677 Cornell Univ., Ithaca, N.Y.
THE THEORY OF THE EXCITATION SPECTRUM OF SUPERFLUID HELIUM
Joseph Paul Straley (Ph.D. Thesis) 1970 116 p
Avail: Univ. Microfilms Order No. 70-12652

We critically review theories of the excitation spectrum for superfluid helium, emphasizing the demonstration of the identity of the single-particle and phonon spectra, the success of these theories in accounting for qualitative features of the spectrum, and the possibility of quantitative application of the theories. Dissert. Abstr.

N71-28687 Princeton Univ., N.J.
DISCHARGE COEFFICIENTS FOR CRITICAL FLOW NOZZLE AND THEIR DEPENDENCE ON REYNOLDS NUMBERS
Stephen Shien-pu Tang (Ph.D. Thesis) 1969 132 p
Avail: Univ. Microfilms Order No. 70-8394

The discharge coefficient of an axisymmetric contoured nozzle under steady, critical flow conditions was studied theoretically and experimentally. In the analysis, axisymmetric compressible laminar boundary layer flow was considered for a perfect gas with Prandtl number unity and viscosity proportional to temperature. The wall was assumed to be adiabatic. Theoretical solutions to the equations describing the discharge coefficient were obtained analytically when the pressure gradient parameter beta was infinite. Numerical computations were carried out for two other cases, beta = 2 and beta = 1. Equations were developed in parametric form for calculating nozzle contours under inviscid flow conditions. Experimental values of discharge coefficient were obtained for seven nozzles with sonic velocity at the throat. Argon, helium, nitrogen, and hydrogen were the working fluids. Over a Reynolds number range from 100 to about 34,000, the discharge coefficient values increased smoothly from about 0.79 to 0.99 Dissert. Abstr.

N71-28688 Iowa State Univ. of Science and Technology, Ames.
APPLICATION OF CYCLIC RELAXATION PROCEDURES TO TRANSONIC FLOW FIELDS
Joseph Leo Steger (Ph.D. Thesis) 1969 157 p
Avail: Univ. Microfilms Order No. 70-13636

The equations of motion for an isentropic, compressible fluid with dependent variables of stream function and density are written in finite difference form. The resulting large system of nonlinear, algebraic equations is then solved in the subsonic and transonic regime by the method of relaxation as adapted for use on digital computers. An investigation of the cyclic iterative technique revealed that this relaxation scheme has convergence criteria analogous to those of a system of linear, first-order, time-dependent differential equations. Subsequently, reliance on this analogy led to the development of numerical techniques which yield a stable, eigenvalue structure at the sonic-line for the system of equations considered. The procedure has been used to calculate the transonic flow field over symmetric airfoils by prescribing the boundary conditions on the perimeter of a coarse, uniform, finite difference network. Transonic results have been obtained with the aid of a cathode ray display system that allows the operator to interact with the computer. Dissert. Abstr.

N71-28689 New York Univ., N.Y.
AXIAL MIXING AND GAS ABSORPTION IN A MULTISTAGE, MECHANICALLY AGITATED COLUMN
Gordon Allen Sullivan (Ph.D. Thesis) 1969 128 p
Avail: Univ. Microfilms Order No. 70-9790

Axial mixing was studied in a 6-in. diameter, 12-stage column of the Oldshue-Rushton design. Eddy diffusivity in the liquid phase (water) was measured experimentally by analysis of the residence-time distribution curves obtained by pulse injection of tracer dye. Results were correlated over a range of impeller speeds from 0 to 2000 rpm and liquid rates from 0.5 to 9 gpm for single phase and the continuous phase of a two-phase air-water system. Axial mixing in the dispersed phase, air, was found to be minimal. Overall mass transfer coefficients were obtained for the absorption of approximately 10 and 20% ammonia-air mixtures in water. Gas flow rates from 5 to 20 lb/hr liquid rates from 70 to 800 lb/hr, and impeller speeds from 0 to 2000 rpm were investigated. The correlations for eddy diffusivity were used to remove the effect of axial mixing; the axial mixing effects reduced the overall mass transfer coefficients by 5 to 50%. Dissert. Abstr.

N71-28690 Pennsylvania State Univ., University Park.
SOME MEASUREMENTS OF PARTICLE VELOCITY AUTOCORRELATION FUNCTIONS IN A TURBULENT FLOW
William Harold Snyder (Ph.D. Thesis) 1969 116 p
Avail: Univ. Microfilms Order No. 70-13888

The particles used were 46.5 micron hollow glass beads (0.26 g/cc), 87 micron glass beads (2.5 g/cc), 87 micron corn pollen (1 g/cc), and 46.5 micron copper beads (8.9 g/cc). The turbulence was generated by a 1-inch, square bar, biplane grid in a vertical wind tunnel. The particles were injected singly into the

flow 20 inches downstream from the grid, and photographs were taken at 10 positions downstream from the grid. The probability densities of particle positions and velocities were Gaussian. The autocorrelations decreased much faster for heavier particles. The integral scale for the copper beads was about 1/3 of that for the hollow glass beads. The particles had significant inertia and crossing trajectory effects. The particle velocity correlations and the Eulerian spatial correlation were coincident when the separation was nondimensionalized by the respective integral scale. There were indications that the smallest particles behaved like fluid points. It appears from the hollow glass bead data that the Lagrangian time integral scale is closely approximated by the ratio of the Eulerian spatial integral scale to the root mean square turbulence intensity.
Dissert. Abstr.

N71-28719 Illinois Inst. of Tech., Chicago.
FLUID DYNAMICS IN FUEL CELLS CAVITIES
Sarvajit Singh Sareen (Ph.D. Thesis) 1970 244 p
Avail: Univ. Microfilms Order No. 70-14932

An anisotropic porous media model has been suggested for fluid motion in fuel cell cavities and has been shown to be valid experimentally with an actual fuel cell plate. Pressure profiles obtained from the analytic solution were compared with the pressure profiles measured on an actual fuel cell plate, and verified to be correct. The solutions of Laplace's equation for pressure were used to study purge efficiencies in fuel cell cavities by analytically constructing purge time curves for various configurations which are of interest in fuel cell design. The concepts of multiplication of solutions, extended orthogonality and Green's functions were used to obtain solutions for one region and composite media problems. For flow through a porous, composite media the Green's function components, for one and two dimensional flow in each of two and three layers, were derived. Dissert. Abstr.

N71-28720 Illinois Univ., Urbana.
CENTRIFUGALLY DRIVEN THERMAL CONVECTION AND GRAVITATIONAL INSTABILITIES IN BOUNDED ROTATING FLUIDS
George Mitchel Homsy (Ph.D. Thesis) 1969 366 p
Avail: Univ. Microfilms Order No. 70-13353

Two broad problems concerning nonisothermal rotating flows are treated theoretically. The first of these concerns centrifugally driven thermal convection in a rotating cylinder of fluid heated differentially in the vertical. Centrifugal acceleration is considered dominant, and the problem is treated using boundary layer methods. The bulk of the analysis is for fluids of moderate Prandtl number, and the horizontal Ekman layers are found to control the inviscid axial flow. The solution also largely depends upon the thermal conditions assumed at the side wall, and if these be insulated, consideration of the side-wall boundary layers is necessary for complete specification of the problem. The second broad problem concerns the stability of a rotating cylinder of fluid heated from below. Both conductive basic states and basic states which reflect the effects of centrifugally produced convection are treated.
Dissert. Abstr.

N71-28721 Ohio State Univ., Columbus.
EXPERIMENTAL AND THEORETICAL INVESTIGATION OF THE NOZZLE FLOW IN A LARGE ARC-HEATED HYPERSONIC WIND TUNNEL
James Thomas van Kuren (Ph.D. Thesis) 1969 223 p
Avail: Univ. Microfilms Order No. 70-14109

Studies were conducted of the chemically reacting air flow in a large arc-heated hypersonic wind tunnel nozzle. The nozzle was conically shaped with a 25.2 inch exit diameter and interchangeable throats of 1 and 2 inches diameter. The air entering the nozzle was heated in a Linde vortex-stabilized high voltage arc-heater at 20 to 100 atmospheres pressure raising its total enthalpy to 1600 to 3900 BTU/LB. The influence of the arc heater flow processes and the shape of the sonic line on the supersonic and hypersonic flow field are briefly discussed. The axiaymmetric flow downstream of the sonic line in the inviscid core was analyzed by the method of characteristics for air in chemical and thermodynamic equilibrium.
Dissert. Abstr.

N71-28728# ARO, Inc., Arnold Air Force Station, Tenn.
EXPERIMENTAL INVESTIGATION OF WATER EJECTION FROM A WEDGE MODEL AT MACH NUMBER 6 Final Report, 15 Jun. – 8 Oct. 1970
R. K. Matthews AEDC Apr. 1971 48 p refs
(Contract F40600-71-C-0002)
(AD-721448; AEDC-TR-71-26) Avail: NTIS CSCL 20/4

Tests were conducted at Mach number 6 to investigate the interaction between an ejected liquid (water) and a two-dimensional, zero pressure gradient boundary layer. Heat-transfer rates, static pressure levels, pitot pressure surveys, and photographic data were obtained on a 33.65-deg wedge model over a Reynolds number range, based on the distance to the ejector, from 260,000 to 3,440,000. The water mass flow range was from 0.013 to 0.064 lbm/sec for both a porous panel and a slot-type ejector. Water ejection at 0.064 lbm/sec increased the boundary-layer thickness about 15 percent, and for all mass flow rates the model surface temperatures were equal to the water temperature (approx. = 75F). The primary data consisted of backlighted photographs of dyed water flowing over a glass plate on a wedge surface.
Author (GRA)

N71-28741* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FLUID JET AMPLIFIER Patent
William S. Griffin, inventor (to NASA) Issued 8 Jun. 1971 7 p
Filed 29 Nov. 1968 Cl. 137-81.5; Int. Cl. F15c1/04
(NASA-Case-XLE-09341; US-Patent-3,583,419;
US-Patent-Appl-SN-780065) Avail: US Patent Office CSCL 20D

A fluid amplifier is provided in which fluid is peeled off the power jet when control nozzle pressure exceeds a prescribed magnitude. The peeled off fluid is redirected at such an angle as to tend to recenter the power jet. Additionally, in an alternate embodiment the control nozzles are aimed at respective flat walls which form an intermediate chamber downstream of the interaction chamber and in communication with a pair of diverging receiver channels. Official Gazette of the U.S. Patent Office

N71-28770 Illinois Univ., Urbana.
TURBULENCE IN THE IMMEDIATE VICINITY OF A WALL AND FULLY DEVELOPED MASS TRANSFER AT HIGH SCHMIDT NUMBERS
Kamalesh Kumar Sirkar (Ph.D. Thesis) 1969 205 p
Avail: Univ. Microfilms Order No. 70-13489

The objectives of this investigation were to measure wall shear stress fluctuations and fully developed mass transfer fluctuations at high Schmidt numbers in turbulent pipe flow and to propose a model for fully developed turbulent mass transport at high Schmidt numbers. Measurements in the fully developed turbulent pipe flow showed the relative axial velocity intensity based on the local average velocity to be 0.356 at the wall. This value of the intensity as well as the axial wall shear stress spectrum when expressed in wall parameters agree substantially with hot wire measurements of axial velocity across the viscous sublayer. These results support a model of an oscillating shear layer responding to shear fluctuations from outside. The axial velocity fluctuations are almost Gaussian but they never produce a negative velocity at the wall. The limiting relative intensity of transverse velocity fluctuations based on the local average velocity was found to be 0.09 at the wall. Dissert. Abstr.

N71-28773 Pennsylvania State Univ., University Park.
TRANSITIONS IN SUPERCRITICAL FLOW: EXPANSIONS

FROM RECTANGULAR TO TRAPEZOIDAL SECTIONS
Holenarasipur Yoganarasimham Rajagopal (Ph.D. Thesis) 1969 170 p
Avail: Univ. Microfilms Order No. 70-13874

Empirical design data and a general procedure for the design of expansions from a rectangular to a trapezoidal section in supercritical open-channel flow are discussed. The test channel, mounted on a 54 ft tilting beam assembly, consisted of a rectangular approach channel 10 ft long, the transition and the downstream trapezoidal channel, with a common central axis. Three different shapes of transitions, Shape A, Shape B and Shape C, were tested at Froude numbers ranging from 1.20 to 3.20. Shape B had warped side walls. Shape A had side walls with a vertical surface over a sloping surface while Shape C had the opposite arrangement. Each shape was tested for various combinations of three approach depths and five transition lengths, making in all 28 transitions. Dissert. Abstr.

N71-28774 Illinois Univ., Urbana.
FLOW NEAR AN ENCLOSED ROTATING DISK
Patrick Frank Tomlan (Ph.D. Thesis) 1969 186 p
Avail: Univ. Microfilms Order No. 70-13519

An analytical study of the flow near an enclosed rotating disk is presented. The system consists of a right-circular cylinder with the top rotating. The flow depends on two parameters: the rotational Renolds number, Re, and the aspect ratio, A. Both finite and infinite Reynolds numbers are studied. Only laminar flow is considered. Dissert. Abstr.

N71-28775 Carnegie-Mellon Univ., Pittsburgh, Pa.
ONE DIMENSIONAL WAVES IN HEAT CONDUCTING SOLIDS WITH FADING MEMORY
Richard Mickelsen (Ph.D. Thesis) 1969 40 p
Avail: Univ. Microfilms Order No. 70-14179

Extrinsically induced shock and acceleration waves, defined as moving discontinuities in the velocity and acceleration fields over a body, respectively, are investigated using the methods of the theory of singular surfaces. The body is composed of material defined by the constitutive assumption that the stress, entropy, free energy, and heat flux are functionals of the present values of the strain and temperature, and of the present values of the strain and temperature, and temperature gradient. Fading memory is assured by multiplying past histories by arbitrary, monotone decreasing functions of past time. The classical field equations of conservation of linear momentum and energy together with the constitutive relations and wave compatibility conditions yield wave amplitude equations dependent on the material properties and the extrinsic driving terms, the body force and heat supply. Dissert. Abstr.

N71-28857*# Techtran Corp., Glen Burnie, Md.
THE RULE OF RADIATION ABSORPTION IN FRONT OF A SHOCK WAVE DURING HYPERSONIC FLOW AROUND A BLUNT BODY [O ROLI POGLOSHCHENIYA IZLUCHENIYA PERED UDARNOY VOLNOY PRY GIPERZVUKOVOM OBTEKANIYI ZAPUPLENNOGO TELA]
V. K. Vertushkin et al Washington NASA Jun. 1971 14 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Zhidk. Gaza (Moscow), no. 6, 1970 p 40-47
(Contract NASw-2037)
(NASA-TT-F-13572) Avail: NTIS CSCL 20D

Conditions on the front of a strong discontinuity of density were obtained together with a calculation of the absorption of the leading radiation. The role of the simultaneously occurring dimensionless parameters was recorded, and evaluation of the values of these parameters was carried out for the entry of blunt bodies into the dense layers of the earth's atmosphere. Calculations were made for a given structure and parameters of the molecular nitrogen flux accumulating on the shock wave, and conclusions were drawn relative to the hypersonic flow around a blunt body together with calculation of the radiation. Author

N71-28868 Illinois Univ., Urbana.
THE NATURE OF SOLUTIONS TO BOUNDARY LAYER PROBLEMS WITH SURFACE REACTION
Robert Clifford Lindberg (Ph.D. Thesis) 1969 172 p
Avail: Univ. Microfilms Order No. 70-13395

Steady states in systems involving laminar boundary layer flow past surfaces on which an exothermic chemical reaction takes place are studied. The equations describing two boundary layer problems are analyzed. The first of these deals with two dimensional flow over a flat plate, and the second with flow around a parabolic cylinder. It is shown that the usual boundary layer equations have a unique solution, while genuine multivalued solutions are possible for those cases which provide for longitudinal conduction of heat in the solid. The transient behavior of heterogeneous reaction in two dimensional stagnation point boundary layer flow is also examined. It is shown that transient simulations show all the types of behavior predicted by a prior linear stability analysis. Dissert. Abstr.

N71-28869 Washington Univ., Seattle.
TWO PROBLEMS IN TURBULENCE. A: A THEORETICAL AND EMPIRICAL STUDY OF THE LIMITING FORM OF THE EDDY DIFFUSIVITY NEAR A WALL. B: MATCHED ASYMPTOTIC EXPANSIONS APPLIED TO THE TURBULENT GRAETZ PROBLEM
Robert Harley Notter (Ph.D. Thesis) 1969 238 p
Avail: Univ. Microfilms Order No. 70-14777

The prediction of heat and mass transfer to fluids flowing in turbulent flow in pipes is discussed. Emphasis is placed on describing such transport in the two extreme cases of high Prandtl number and of low Prandtl number (liquid metal systems). Two wall boundary conditions of practical importance, uniform wall temperature and uniform wall heat flux, are investigated. Numerical solutions of the relevant eigenvalue problem are obtained for the lower eigenvalues and constants, and rigorous asymptotic expressions are obtained for the higher eigenvalues and constants. The liquid metal eddy diffusivity relations of Awad are verified for use in the low Prandtl number range. A limiting form for the eddy diffusivity near the wall in the high Prandtl number range is obtained from theoretical and empirical considerations. Dissert. Abstr.

N71-28876# Illinois Inst. of Tech., Chicago. Dept. of Mechanical and Aerospace Engineering.
NEW INSIGHTS ON TRANSITION IN OSCILLATING BOUNDARY LAYERS
Richard Loehrke, Mark V. Morkovin, and Andrew A. Fejer Apr. 1970 78 p refs Presented at the Fluid Dyn. Symp., Hamilton, Ontario, 25-27 Aug. 1970
(Contract F44620-69-C-0022; Proj. Themis)
(AD-720292; THEMIS-TR-70-2; AFOSR-70-1586TR) Avail: NTIS CSCL 20/4

Literature on transition in oscillating boundary layers is relatively recent and confusing. The paper first reviews the current thinking on transition in steady boundary layers and on the role of stability theory. The reader is then provided with a background on oscillating boundary layers. The various reports of transition in such boundary layers are analyzed and clarified. The concept of excited wave packets, moving downstream through the pulsating boundary layer and cumulatively growing or decaying, largely in response to the transient vorticity distribution, appears to unify much of the data. Recent experiments, designed to test the ingredients of the concept, are reported. Other forms of transition are discussed and their probable occurrence in the domains of interest to practical engineers is mapped out. Author (GRA)

N71-28876 Michigan Univ., Ann Arbor.
DENSITY DISTRIBUTION MEASUREMENTS IN CYLINDRICAL COUETTE FLOW OF RAREFIED ARGON
Darryl John Alofs (Ph.D. Thesis) 1969 79 p
Avail: Univ. Microfilms Order No. 70-14461

Density distributions were measured in rarefied argon contained between two concentric cylinders undergoing relative rotation. The experiments were performed with a Mach number near unity, based on the surface speed and surface temperature of the inner cylinder. The Knudsen number, defined as the ratio of the mean free path to the gap size between the cylinders, varied from 0.04 to 1.07, so that both near-continuum (slip) and transition regime conditions were obtained. The density distributions were measured by observing the gas luminescence induced by the passage of a narrow beam of high energy electrons through the gas. In addition to the density measurements, heat transfer and drag measurements were also made in order to estimate the values of the thermal and tangential momentum accommodation coefficients. Dissert. Abstr.

N71-28882*# Stanford Research Inst., Menlo Park, Calif.
A STUDY OF THE STRUCTURE OF JET TURBULENCE PRODUCING JET NOISE
D. C. Wooten, C. E. Wooldridge, A. J. Amaro, and G. R. Plapp
Washington NASA Jul. 1971 83 p refs
(Contract NASw-1938)
(NASA-CR-1836) Avail: NTIS CSCL 04D

The turbulent structure in the mixing region for the first few diameters downstream from the outlet of a circular subsonic jet is characterized at three Mach numbers, 0.3, 0.5, and 0.7, at two different levels of core turbulence. A digital data reduction program was used to calculate auto- and cross-correlations of axial velocity fluctuations and the power spectral densities. Convection velocities were measured using the overall hot wire signals and using signals that were digitally filtered for band-passes about center frequencies of 0.875, 3.5, and 8.5 kHz. The convection velocities of the lower frequency components of the signals were lower and varied more slowly with radial position than the convection velocities of the higher frequency components and of the overall signal. Thus the large eddies which correspond to the low frequency components are convected at roughly a constant velocity across the shear layer which is about 0.6 of the jet velocity. This corresponds to the convection speed of coherent pressure fluctuations that have been observed across the jet core. This observation supports the hypothesis that the coherent pressure field is driven by the intermittent fluctuations at the core boundary which in turn are related to the large (low frequency) eddies. Author

N71-28894 Michigan Univ., Ann Arbor.
LOCAL HEAT TRANSFER FOR FLOW IN A RADIAL DIFFUSER
Ronald Ashley McMaster (Ph.D. Thesis) 1969 140 p
Avail: Univ. Microfilms Order No. 70-14596

The experimental heat transfer investigation is carried out with air as the fluid. Inlet Reynolds numbers ranged from 15 to 53,500 and area ratios from .245 to 2.04. The outside diameter and 8.7 times the inside diameter. Measured heat transfer rates at the stagnation point for laminar and turbulent flows and in the diffuser region for laminar flow are adequately described analytically. Experimental heat transfer rate distributions are presented for both laminar and turbulent flows over an inlet Reynolds number range of 115 to 7700. Correlations for the average heat transfer rates determined from experimental heat transfer distributions are presented for inlet Reynolds numbers from 115 to 53,000. Dissert. Abstr.

N71-28897 Washington Univ., Seattle.
SHOCK WAVE-BOUNDARY LAYER INTERACTIONS IN TWO-DIMENSIONAL AND AXIALLY-SYMMETRIC FLOWS INCLUDING THE INFLUENCE OF SUCTION
Douglas Charles Mathews (Ph.D. Thesis) 1969 303 p
Avail: Univ. Microfilms Order No. 70-14772

Experimental data were obtained for axially-symmetric interactions at a free-stream Mach number of 1.99, with a Reynolds number based on the upstream boundary layer thickness of 3.4 × 10,000. Bleed holes were drilled through the test-section walls in order to study the effects of boundary layer suction on the characteristics of the interactions and on the occurrence of shock-induced boundary layer separation. Flow field and boundary layer properties obtained upstream and downstream of the interaction regions are presented for a number of shock wave strengths and suction flow rates. The theoretical results agree favorably with experimental data obtained concurrently and from other sources for moderate strength shocks waves and moderate suction flow rates. Results indicate that the proposed two-parameter boundary layer velocity profile representation provides a substantial improvement over the single-parameter power-law distribution in flows where there is a significant departure of the boundary layer from flat plate flow. Dissert. Abstr.

N71-28927# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
UNSTEADY FLOW AROUND AND AEROELASTIC VIBRATION IN TURBOMACHINE CASCADES
G. S. Samoilovich 23 Feb. 1971 541 p refs Transl. into ENGLISH of the book "Nestatsionarnoe Obtekanie i Aerouprugie Kolebaniya Reshetok Turbomashin" Moscow, Izd-Vo Nauka, 1969 p 1–444
(AD-721959; FTD-HC-23-242-70) Avail: NTIS CSCL 21/5

Methods of calculating, and experimental results of research on, unsteady flow in aerodynamic cascades of turbomachines are set forth. The conditions of excitation and damping of blade vibration in compressible and incompressible fluid flow are considered. The theoretical methods are based upon a model of an ideal fluid. The incoming stream may be inhomogeneous and have vortices due to the influence of a preceding cascade. The experimental results pertain to determination of the dynamic stresses brought about by stream inhomogeneity in the turbomachine, as well as to determination of the unsteady aerodynamic forces which excite and damp blade vibrations. Consideration is given to the origination of cascade flutter and the effect of inhomogeneity of an aerodynamic cascade. The experimental research methods are described. Author (GRA)

N71-28953*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN INVESTIGATION OF GAS DYNAMIC AND TRANSPORT PHENOMENA IN THE TWO DIMENSIONAL JET INTERACTION FLOW FIELD
W. J. Thayer, III, and R. C. Corlett (Wash. Univ., Seattle) [1971] 35 p refs Presented at 4th Fluid and Plasma Dyn. Conf., Palo Alto, Calif., 21–23 Jun. 1971; sponsored by AIAA
(NASA-TM-X-67862) Avail: NTIS CSCL 20D

Pressure, temperature, gas sampling, and optical measurements were made in the turbulent separated flow region upstream of jets. Hot hydrogen, helium, and nitrogen were injected from a converging slot nozzle perpendicular to the heated Mach 2.8 airstream above a flat plate. The dependence of the separation distance, wall pressure, and side force on the jet to free stream pressure and density ratios and the separation Reynolds number was determined. The recirculation region injectant concentration was high. An experimental technique employing tracer gas injection was proposed and implemented to determine air and injectant mass transport rates through the separated flow region. Author

N71-29029 Illinois Univ., Urbana.
TURBULENT JET OF A CHARGED SUSPENSION
Yong Nak Lee (Ph.D. Thesis) 1969 124 p
Avail: Univ. Microfilms Order No. 70-13389

A two phase axisymmetric turbulent free jet of .1 inch diameter of neutral and charged particle suspensions at relatively low Reynolds numbers were studied with particles of glass beads (average diameter 35.5 microns) and aluminum oxides (average size 29.5 microns). Measurements included distributions of the gaseous velocity, the mass flux density distributions, the average charge to mass ratio and the particle size distributions. Experimental results agreed with Soo's analytical solutions. Even if the velocity profiles in the initial region did not conform to the laminar profiles, the mass flux density profiles followed Soo's solution. Dissert. Abstr.

N71-29030 Washington Univ., Seattle.
LAMINAR FREE CONVECTION OF NON-NEWTONIAN FLUIDS FROM A VERTICAL FLAT PLATE WITH UNIFORM SURFACE HEAT FLUX
James Douglas Dale (Ph.D. Thesis) 1969 350 p
Avail: Univ. Microfilms Order No. 70-14748

The net heat transfer, and temperature and velocity profiles for laminar free convection of non-Newtonian fluids from a vertical flat plate with uniform surface heat flux were studied experimentally and investigated numerically. The non-Newtonian fluids were produced by dispersing carboxymethycellulose (C.M.C.) or carboxypolymethylene (Carbopol) powder in water. The thermal conductivity of the fluids was found to be nearly equal to that of water and the rheological behavior to follow the Ostwald-de Waele power law model. Numerical solutions were obtained to the partial differential conservation equations used to describe the free convection flow for constant and variable property cases and showed excellent agreement with the experimental measurements. Dissert. Abstr.

N71-29031 California Univ., Berkeley.
MASS TRANSFER TO A ROTATING DISK
Bart Trousdale Ellison (Ph.D. Thesis) 1969 96 p
Avail: Univ. Microfilms Order No. 70-13043

Experimental rates are reported for oxygen mass transfer to a disk rotating in 3-1/2 percent aqueous NaCl. Average Sherwood numbers were obtained over a range of temperatures from 33 F (1 C) to 210 F (99 C) and a range of Reynolds numbers, Re, from 10,000 to 1.18 × 10 to the 7th power and a range of Schmidt numbers, Sc, from 34 to 1400. The laminar flow results agree with the Newman extension of the Levich theory for Sc > 100 and with the Sparrow and Gregg theory for Sc < 100. Transition from laminar to turbulent flow was found to occur at Re = 3.0 × 100,000. Dissert. Abstr.

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N71-28016*# Techtran Corp., Glen Burnie, Md.
THE DEPENDENCE OF THE VELOCITY OF PROPAGATION OF ULTRASOUND ON ROCK POROSITY [ZAVISIMOST SKOROCTI RASPROSTRANENIYA ULTRAZVUKA OT PORISTOSTI GORNYKH POROD]
T. S. Izotova Washington NASA Jun. 1971 9 p refs Transl. into ENGLISH from Geol. Nefti i Gaza (Moscow), no. 11, 1969 p 52–54
(Contract NASw-2037)
(NASA-TT-F-13696) Avail: NTIS CSCL 08G

A study was made of the propagation velocity of ultrasound in natural rocks of known porosity (impregnated with mineralized water), artificial rocks (prepared from sand and cement) of known porosity, and of sand-clay-water suspensions. From this it has been concluded that only two of the best known equations which were used to correlate propagation rate with porosity have any applicability, the others giving excessively high porosities for a given velocity. Of the two which are useful, one is applicable only at low porosities; and the other, at porosities over 35%. Author

N71-28148# Joint Publications Research Service, Washington, D.C.
OCEANOGRAPHY
In its Soviet-Bloc Res. in Geophys., Astronomy, and Space, No. 253 1 Jun. 1971 p 40–46 (See N71-28145 16-30)
Avail: NTIS

News briefs and abstracts of scientific articles concerning Soviet developments in oceanography are presented. The following topics are discussed: ocean currents, mineral wealth of oceans, tectonic aspects of petroleum and gas accumulation in the oceans, and turbulent diffusion in the Black Sea. F.O.S.

N71-28149# Joint Publications Research Service, Washington, D.C.
TERRESTRIAL GEOPHYSICS
In its Soviet-Bloc Res. in Geophys., Astronomy, and Space, No. 253 1 Jun. 1971 p 47–61 (See N71-28145 16-30)
Avail: NTIS

News briefs and abstracts of scientific articles concerning terrestrial geophysics are presented. Subjects discussed include: marine gyrostabilized gravimeter, latest developments in Soviet geology, rocks with high thermodynamic parameters, methods for studying deep electric conductivity, vertical distribution of magnetic field Z-component variations at sea, and frequency of recurrence of earthquakes. F.O.S.

N71-28150# Joint Publications Research Service, Washington, D.C.
UPPER ATMOSPHERE AND SPACE RESEARCH
In its Soviet-Bloc Res. in Geophys., Astronomy, and Space, No. 253 1 Jun. 1971 p 62–103 (See N71-28145 16-30)
Avail: NTIS

News briefs and abstracts of scientific articles concerning Soviet developments in the ionosphere and space sciences are presented. Subjects discussed include: Soyuz-10 flight, radiation belts and cosmic rays, launching of Cosmos-407, 408, 409, and 410, interaction between galactic cosmic rays and interplanetary field, spectrum of hydromagnetic noise in proton belt, numerical model of heat exchange in Venusian atmosphere, ionospheric effects during solar eclipse, and optimization of trajectory measurements. F.O.S.

N71-28151# Joint Publications Research Service, Washington, D.C.
MISCELLANEOUS
In its Soviet-Bloc Res. in Geophy., Astronomy, and Space, No. 253 1 Jun. 1971 p 104–106 (See N71-28145 16-30)
Avail: NTIS

Soviet glaciological research in the Arctic is reported. Radar soundings indicate that the glacier domes of Severnaya Zemlya are 600 to 700 m thick. It is concluded that present-day climatic conditions are unfavorable for the existence of glaciers. F.O.S.

N71-28207# Harvard Univ., Cambridge, Mass. Lab. for Computer Graphics and Spatial Analysis.
GEOGRAPHY AND THE PROPERTIES OF SURFACES SERIES: THE HEXAGON AS A SPATIAL AVERAGE Interim Report
Michael J. Woldenberg 15 Oct. 1970 28 p refs *Its* Paper 42

(Contract N00014-67-A-0298)
(AD-722022; ONR-TR-42) Avail: NTIS CSCL 8/6

The paper demonstrates that river basin areas and central place market areas tend to be hexagonal. River basins are bounded by ridge lines which meet three at a corner. Fewer ridge lines cannot define a corner, and more ridge lines are improbable. The nomenclature of river basins following Warntz (1968) and Schumm (1956) is extended. Market areas must have three-edged corners Graustein (1932) showed that large networks with three-edged corners must tend to have six sides per polygon, a relation that follows from Eulers law. The most, if not all, commonly occuring natural networks have three-edged corners, the polygons tend to be hexagons. Author (GRA)

N71-28208# Newmark (Nathan M.), Urbana, Ill.
DEVELOPMENT OF A TRANSMITTING BOUNDARY FOR NUMERICAL WAVE MOTION CALCULATIONS Final Report
A. H.-S. Ang and Nathan M. Newmark Apr. 1971 165 p refs
(Contract DASA01-69-C-0040)
(AD-722087; DASA-2631) Avail: NTIS CSCL 8/11

A numerical discrete-element method of wave motion analysis is summarized and extended for problems involving infinite or semi-infinite solid media in plane and axi-symmetric conditions. Space discretization of a solid medium is accomplished through a lumped-parameter discrete-element model of the medium, whereas the time discretization is embedded within a general numerical integrator. This invariably leads to a system of finite difference equations; thus, the required mathematical conditions for numerical stability can be developed on the basis of available finite difference theory. Explicit stability conditions for plane and axi-symmetric problems are presented. Calculations of wave motions in an infinite or semi-infinite space can be confined to a finite region or interest if the region is terminated by suitable transmitting boundaries such that no significant reflections are generated at these artificial boundaries. Based on the concept of a step-wise transmission of D'Alembert forces, a general transmitting boundary was developed for the discrete-element method of analysis. The boundary was verified extensively through actual calculations of plane strain and axi-symmetric problems, including those with layered half-spaces, elastic-plastic systems, and a problem involving long calculation time. Author (GRA)

N71-28209# Technische Hogeschool, Delft (Netherlands). Afdeling der Technische Natuurkunde.
STRESSES DUE TO GRAVITY IN AN ELASTIC HALF-PLANE WITH NOTCHES OR MOUNDS
Arnold Verruijt (Ph.D. Thesis) 1969 137 p refs
Avail: NTIS

Stresses are calculated in a homogeneous, isotropic, linear elastic material, initially occupying a lower half-space, and in equilibrium under its own weight. The investigations refer to the states of stress in the material when the originally plane upper boundary is modified by notches, or mounds. Although the problems treated occur in soil mechanics the solutions presented apply to a mechanically much simpler material than soils. ESRO

N71-28220*# Techtran Corp., Glen Burnie, Md.
THE POSSIBLE THERMAL EFFECT OF TECTONIC DEFORMATION OF ROCKS [O VOZMOZHNOM TERMICHESKOM EFFEKTE TEKTONICHESKOGO DEFORMIROVANIYA GOVNYKH POROD]
E. I. Petalakha et al Washington NASA Jun. 1971 11 p refs Transl. into ENGLISH from Izv. Akad. Nauk Kazakh. SSR, Ser. Geol. (Alma-Ata), no. 5, 1969 p 19–26
(Contract NASw-2037)
(NASA-TT-F-13707) Avail: NTIS CSCL 08G

Several types of rock were subjected to compression tests and the experimental data were used for the variables in a common formula to derive rough values for the thermal effect of deformation. It is concluded that the folding process is a pulsating action with periods of deformation interrupted by static periods, and that heat accumulation is possible if the pulses of deformation occur at approximately 1,000 year intervals. The folding processes can, in themselves, create thermal gradients in rocks. The conditions of deformation are assumed to be adiabatic and the thermal effect will amount to at least 150 – 160 deg. Author

N71-28246# Technische Hogeschool, Delft (Netherlands). Afdeling der Technische Natuurkunde.
THE APPLICATION OF LINEAR FILTER THEORY OF THE DIRECT INTERPRETATION OF GEOELECTRICAL RESISTIVITY MEASUREMENTS
Deva Prasad Ghosh (Ph.D. Thesis) 1970 125 p refs
Avail: NTIS

A direct method for interpreting geoelectrical resistivity measurements is developed, based on sampling and linear filter theory. A function is derived called the resistivity transform function T, related to the kernel, from the apparent resistivity curve. The layer parameters can then be obtained from the T curve directly. ESRO

N71-28268# Shell Exploration and Production Lab., Rijswijk (Netherlands).
ANALYSIS OF ELECTROMAGNETIC PROSPECTING DATA BY MEANS OF APPARENT WAVE NUMBERS
Petrus Johannes Maria Thomeer (Ph.D. Thesis, Tech. Hogeschool Delft) 1970 115 p refs
Avail: NTIS

The disturbing influence on applied magnetic fields caused by the electrical properties of subsurface rocks is investigated by means of an apparent wave number, from which the components of the electromagnetic field strength for an inhomogeneous surface such as a multilayer structure can be computed. The influence of the structure, caused by the electrical properties of the layers, on the magnitude of the measured field strength is analyzed. ESRO

N71-28280*# Scripta Technica, Inc., Washington, D.C.
THE NATURE OF THE ANISOTROPY OF THE ELASTIC PROPERTIES OF MONOMINERAL ROCKS [PRIRODA ANIZOPTROPII UPRUGIKH SVOYSTV MONOMINERALNYKH KARBONATNYKH POROD]
L. I. Zvaygintsev et al Jun. 1971 12 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Ser. Geol. (Moscow), no. 5, 1970 p 71–79
(Contract NASw-2036)
(NASA-TT-F-13673) Avail: NTIS CSCL 08G

Factors causing anisotropic elasticity in monomineral carbonate rocks were investigated. Ultrasonic measurements of longitudinal wave velocities were taken in marbles, fine-grained dolmites, and pelitomorphic limestones from which elastic constants were calculated. X-ray analysis of the samples determined the crystallite orientations. The sample densities, porosities, and permeabilities were also assessed. Vectorial distributions of longitudinal wave velocities and directions of preferential crystallite orientation are shown. J.M.

N71-28320*# Stanford Univ., Calif. Dept. of Petroleum Engineering.
MEASUREMENT OF EXTREMELY LOW FLUID PERMEABILITIES OF ROCKS SIGNIFICANT TO STUDIES OF THE ORIGIN OF LIFE Final Report
Sullivan S. Marsden, Jr. Jun. 1971 31 p refs
(Grant NGR-05-020-331)
(NASA-CR-119021) Avail: NTIS CSCL 08G

An investigation was conducted into the design, construction

and use of an instrument used to measure the low liquid permeabilities of rocks. Pressure measurements were made and Darcy's law was used quantitatively to describe the linear flow of the fluid. The rocks, thought to contain organic compounds, are used to study the origin of life. E.H.W.

N71-28328*# Ocean Data Systems, Inc., Rockville, Md.
ADVANCED STUDY OF COASTAL ZONE OCEANOGRAPHIC REQUIREMENTS FOR ERTS E AND F
D. A. Adams, J. Fry, H. Gurk, J. Hudgens, R. Newell et al 18 Feb. 1970 162 p refs
(Contract NAS1-10281)
(NASA-CR-111823) Avail: NTIS CSCL 08J

The important coastal zone issues and marine-related data needed to aid in resolving them are identified. The data which might be acquired by satellite and the appropriate orbital and sensor characteristics for coastal missions are outlined. Recognizing the importance of high resolution and high frequency of coverage for these missions, the proposed spacecraft characteristics are: orbital inclination 72 degrees optimized for the coastal zone at an altitude of about 700 km with a high resolution multispectral imager, an IR imager, a low resolution multispectral imager, and visible near-IR spectrometer. Sensors should be pointable so that most coastal areas can be observed possibly on three out of four days. Author

N71-28329*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THERMOSPHERIC HYDROGEN: ABSOLUTE DENSITIES AND TEMPORAL VARIATIONS DEDUCED FROM IN SITU MEASUREMENTS
Henry C. Brinton and Hans G. Mayr Jun. 1971 30 p refs Presented at the 14th Plenary Meeting of COSPAR, Seattle, 21 Jun.–2 Jul. 1971 Submitted for publication *Its* Paper f.41
(NASA-TM-X-65589; X-621-71-233) Avail: NTIS CSCL 04A

The concentration of atomic hydrogen at 350 km altitude was derived from Explorer 32 measurements of ion composition and model n(O) values by consideration of the charge exchange equilibrium $O(+) + H \rightleftharpoons H(+) + O$. The measurements, made at northern temperate latitudes between June 1966 and January 1967, were analyzed for thermospheric hydrogen density and its temporal variations based on in situ observations. During the period of measurement the average F sub 10.7 increased from 100 to 140, and n(H) varied between approximately 400,000 and 80,000/cucm, with a mean value of 230,000/cucm. Employing the Jacchia formulation for the primary components of the exospheric temperature, parametric analysis resolved the n(H) variations into contributions associated with temperature components due to solar activity, local time, geomagnetic activity, and the semi-annual effect. With one exception, the hydrogen concentration was observed to vary inversely with each of the model temperature components, as theoretically expected; the semi-annual variations in n(H), though small, appeared to vary directly with temperature. Author

N71-28345# New York Univ., N.Y. Geophysical Sciences Lab.
THE REFRACTION OF TRANSIENT WAVE GROUPS ACCORDING TO THE PHASE SPEED OF THE FOURIER SPECTRAL COMPONENTS
Willard J. Pierson, Jr. and Yung-Yao Chao Mar. 1971 32 p refs
(Contract N00014-67-A-0467-0012)
(AD-722037; GSL-TR-71-5) Avail: NTIS CSCL 20/4

Transient wave groups were generated in a wave tank with a bottom of variable depth. The transients were recorded at several places in the tank in such a way as to compare two alternative hypotheses: one that the waves refracted according to refraction equations involving their spectral phase speeds, and the other that group velocities were involved. The measurements show that the wave groups were refracted according to the phase speed of the spectral components. Author (GRA)

N71-28346# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
STRATOPAUSE DIURNAL OZONE VARIATION
J. S. Randhawa Jan. 1971 32 p refs
(AD-721309; ECOM-5355) Avail: NTIS CSCL 4/1

The dual-sensor (temperature-ozone) rocket-borne ozonesonde developed by the Atmospheric Sciences Laboratory, White Sands Missile Range, New Mexico (WSMR), was used in the study of diurnal variation of ozone in the stratosphere and mesosphere. Five instruments were rocket launched on 25 May 1970 within a 24-hour period from WSMR (32N). Two instruments were flown near noon, two near midnight and one an hour before local sunset. Data obtained for temperature and ozone show significant variations within a 24-hour period in the upper stratosphere and lower mesosphere. An electrochemical balloon-borne ozonesonde (Mast) was also flown during this period to compare the data from the two systems in the region of overlap. Author (GRA)

N71-28347# Naval Postgraduate School, Monterey, Calif.
THE TEMPERATURE-PRESSURE DEPENDENCE OF IONIC CONDUCTIVITY IN SEA WATER AT TEMPERATURES IN THE OCEANIC RANGE
Bobby Vernon Hassler (M.S. Thesis) Mar. 1971 22 p refs
(AD-721573) Avail: NTIS CSCL 8/10

The specific conductance of three sea water samples (33.634%/oo, 34.099%/oo and 35.001%/oo) was measured at twelve temperatures from 0C to 21.00C and at nine pressures from atmospheric to 4,141.8 decibars above atmospheric. Polynomials for specific conductance as a function of temperature and as a function of pressure are computed from the data, but the temperature-pressure effect is obscure. Two empirical equations that relate conductivity ratio to temperature and pressure are also developed. These equations better describe the temperature-pressure effect on conductivity at the pressures studied which correspond to the upper 4,000 meters of the ocean. Author (GRA)

N71-28350# Air Force Cambridge Research Labs., Bedford, Mass. Ionospheric Physics Lab.
INVESTIGATION OF THE 60 GHz ATMOSPHERIC OXYGEN MANTLE FOR APPLICATION TO VERTICAL SENSING
Donald A. Guidice 26 Jan. 1971 63 p refs
(AD-722044; AFCRL-71-0116; ERP-348) Avail: NTIS CSCL 4/1

The feasibility of a microwave vertical sensor depends on the uniformity of the radiometric temperature of the earths O2 mantle at some operating frequency in the 60-GHz(5-mm wavelength) range. The essential properties of passive vertical sensors are examined. The characteristics of the 5 mm O2-band emission from the earths atmosphere are analyzed. The potential accuracy of a 60 GHz O2-band vertical sensor is determined, considering both instrumental and O2 mantle uniformity limitations. To take the data required to evaluate the O2 mantle uniformity, a downward-looking radiometric instrument operating at 60.80 GHz was designed and built by Ewen-Knight Corporation. The design of the instrument is analyzed from the atmospheric physics and the instrument engineering viewpoints. The instrument, designated Experiment CRLF 739, was accepted for flight aboard the OAR satellite OV1-86; the details of interfacing the instrument with OV1-86 are discussed. Author (GRA)

N71-28351# IIT Research Inst., Chicago, Ill.
NUCLEAR WEAPONS EFFECTS: DUST AND AIR TEMPERATURE ENVIRONMENT
James J. Swatosh, Jr. and Arne H. Waldermann Feb. 1971 287 p refs
(Contract DACA73-67-C-0018)
(AD-722252; CERL-TM-S-2) Avail: NTIS CSCL 18/3

The manual presents a computer program for calculating the dust and air temperature environment resulting from nuclear

weapons detonations. The program can accommodate a wide variety of weapons detonations and ground surfaces. A weapons effects subroutine limits battle environment input data to the bare minimum. Dust concentrations can be calculated at any significant range from ground zero and at any height to which dust is raised by blast wind erosion of soil and subsequent air transport. The soil may be considered either uniform or variable in the path of the blast wave. Soils are specified by particle size and terminal velocity, size distribution, and erodable depth. Land use is accounted for. The topography is assumed to be flat or gently rolling. Multiple burst dust concentrations can be computed for variously timed detonations. The effect of prevailing winds is introduced after cessation of blast winds. Air temperature is treated as a dust-related phenomenon. The ground, heated by thermal radiation prior to arrival of the air blast, is eroded and transported by the blast wind. Its heat is transferred to air, primarily by convection, until thermal equilibrium is attained. The dust present from preceding bursts acts as a heat shield, transmitting only a portion of thermal radiation from succeeding bursts. Author (GRA)

N71-28408# Naval Postgraduate School, Monterey, Calif.
ANALYSIS OF TEMPERATURE AND VELOCITY FLUCTUATIONS IN THE ATMOSPHERIC BOUNDARY LAYER
Thomas Edward Gill (M.S. Thesis) Mar. 1971 57 p refs
(AD-721840) Avail: NTIS CSCL 4/1

Measurements of high frequency temperature and velocity fluctuations were made in the atmospheric boundary layer. These data were analyzed using analog correlating techniques to obtain the structure function rather than spectral methods to obtain the spectral densities. The autocorrelation function of temperature fluctuations at 4 meters and 2 meters was computed as was the autocorrelation function of downstream velocity fluctuations at 4 meters. The cross-correlation function of temperature and downstream velocity fluctuations at 4 meters was also examined. Author (GRA)

N71-28426# Colorado State Univ., Fort Collins. Dept. of Electrical Engineering.
ELECTRON CONTENT MEASUREMENTS AND F REGION MODELING APPLIED TO IONOSPHERIC PARAMETER DETERMINATION
F. L. Smith, III Mar. 1971 63 p refs
(Contract F19628-70-C-0035)
(AD-722042; AFCRL-71-0083; SR-4) Avail: NTIS CSCL 4/1

The theory relating the ionospheric electron content to electromagnetic propagation effects along transionospheric paths is reviewed and measurements of the diurnal variation of the electron content are presented. The possibility of using continuous electron content measurements to determine basic F region parameters, such as ionization and recombination rates, as well as to explain anomalous features of F region behavior is discussed. An appendix contains graphical and numerical presentations of electron content values derived from observations of VHF transmissions from the ATS-I satellite between October 1, 1968 and December 31, 1969. Author (GRA)

N71-28440# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
CHARACTERISTICS OF THE MEAN WIND AND TURBULENCE IN THE PLANETARY BOUNDARY LAYER
H. W. Teunissen Oct. 1970 68 p refs *Its* UTIAS Review No. 32
(Contract F33615-68-C-1055)
(AD-722047) Avail: NTIS CSCL 4/1

Considerable information is available to date concerning the characteristics of the flow in the planetary boundary layer, which comprises roughly the lowest two thousand feet of the atmosphere. Unfortunately, in many instances, the results from different sources do not always agree. This is in part due to the extremely complex nature of the flow and as a result, some confusion exists as to the exact descriptions of the planetary layer. For this reason, a fairly extensive survey of the existing data has been carried out, and the results of this review are presented herein. The planetary layer is described in detail with respect to both mean velocity and turbulence, and the effect of thermal stability and surface conditions on these characteristics is discussed. Finally, a simplified analytical representation of the flow in the planetary layer is presented. Author (GRA)

N71-28444*# Planning Research Corp., Los Angeles, Calif.
A SYSTEMS ANALYSIS OF APPLICATIONS OF EARTH ORBITAL SPACE TECHNOLOGY TO SELECTED CASES IN WATER MANAGEMENT AND AGRICULTURE. VOLUME 1: TECHNICAL SUMMARY
Nov. 1969 64 p refs Revised
(Contract NASw-1818)
(NASA-CR-119010; PCR-R-1224-Vol-1-Rev) Avail: NTIS CSCL 02C

A concept for employing multispectral remote sensors onboard spacecraft as a part of an information system to assist in management of specific water resource and agricultural activities is proposed and evaluated. The specific applications studied were (1) water management of the Columbia River Basin to increase benefits from hydropower generation, irrigation, flood control, navigation, and recreation; (2) management of wheat crop yield and inventory control for the United States, considering worldwide wheat demand and production; and (3) early detection and control of wheat rust fungi to increase the wheat yield in the United States. The system concept includes four satellites, each carrying three remote sensors along with appropriate equipment for attitude control, data storage, and telemetry. A multispectral scanner, a multispectral television, and a multiband radar are used for remote sensing of earth phenomena. The ground components comprise five data receiving (and command and control) sites that forward data to a centralized location for processing and information analysis. The estimated total incremental cost of this conceptualized system was compared with the estimated potential benefits from each application. Benefits and cost of the space-assisted information system were compared to benefits and costs of an aircraft-assisted information as well as of selected non-information alternatives. Author

N71-28445*# Planning Research Corp., Los Angeles, Calif.
A SYSTEMS ANALYSIS OF APPLICATIONS OF EARTH ORBITAL SPACE TECHNOLOGY TO SELECTED CASES IN WATER MANAGEMENT AND AGRICULTURE. VOLUME 2: TECHNICAL REPORT
Nov. 1969 323 p refs Revised
(Contract NASw-1818)
(NASA-CR-119011; PRC-R-1124-Vol-2-Rev) Avail: NTIS CSCL 02C

A systems analysis is presented of three of the many uses of space technology for earth applications including the management of the regional demand and supply of water (emphasizing the generation of hydroelectric power, flood control, irrigation, and recreation); the management of the world wheat crop (emphasizing the impact of fluctuations on the United States as the major exporter); and the control of wheat rust, a principal cause of wheat losses in the United States and abroad. The estimated total system costs, including R and D, investment, and 20 years' annual operating costs were evaluated. The United States' benefits from the three cases were estimated at 10.5 billion for the 1970-90 period, and world benefits were estimated at $50 billion. The wheat rust case requires more frequent monitoring (every 12 hours) by the four-satellite system proposed and the use of radar. Aircraft overflights offer a lower cost alternative than a satellite system used solely for wheat rust control. The water management case required 6-hour coverage and the full use of the satellite system. The cost-benefit ratios are substantial, and the satellite is superior to aircraft and other alternatives if a major portion of the United States' river basins are covered. Author

N71-28446*# Planning Research Corp., Los Angeles, Calif.
A SYSTEMS ANALYSIS OF APPLICATIONS OF EARTH ORBITAL SPACE TECHNOLOGY TO SELECTED CASES IN WATER MANAGEMENT AND AGRICULTURE. VOLUME 2: TECHNICAL REPORT, APPENDIXES
Nov. 1969 558 p refs Revised
(Contract NASw-1816)
(NASA-CR-119012; PRC-R-1224-Vol-2-App-Rev) Avail: NTIS HC $6.00/MF $0.95 CSCL 02C

Appendices are presented for the systems analysis of satellite borne remote multispectral sensors for application to water and wheat crop management and wheat fungi control. Hydrology and agriculture user sensor models and hydrological models are included as well as system operation and benefits, date, satellite system description and costs, alternative information systems, noninformation alternatives, wheat production management, and wheat rust control. J.M.

N71-28451# Hughes Research Labs., Malibu, Calif.
DEVELOPMENT OF A GRADIOMETER FOR MEASURING GRAVITY GRADIENTS UNDER DYNAMIC CONDITIONS Final Report, 15 Apr. 1969 - 14 Aug. 1970
Charles B. Ames, Curtis C. Bell, Robert L. Forward, Glenn F. Kloiber, Robert W. Peteson, et al Nov. 1970 177 p refs
(Contract F19628-69-C-0219)
(AD-721742; AFCRL-71-0003) Avail: NTIS CSCL 8/5

Design and development of a portable rotating gravitational gradiometer has been continued. A breadboard laboratory model of the gradiometer was constructed and tested. Testing has indicated that angular rate isolation and spin speed control represent major factors in maintaining noise free sensor operation. Analysis has been performed on the sensors succeptability to angular rate and a feasible rate isolation method is outlined. Preliminary design studies for an isoelastic servo-balanced arm have been completed and are discussed. A preliminary design specification for an appropriate inertial platform for use in an airborne application was generated, and vendor liaison was established to obtain initial response to this specification. Studies were also performed on sensor angular position errors, noise and clutter due to proximate masses, and first stage vibration isolation methods. Author (GRA)

N71-28452# Naval Oceanographic Office, Washington, D.C.
THE TRANSVERSE SYSTEMS OF COORDINATES FOR THE ARCTIC
D. A. Drogaitsev 1971 13 p refs Transl. into ENGLISH from Probl. Severa (USSR), no. 1, 1958 p 346-353
(AD-720149; NOO-TRANS-76) Avail: NTIS CSCL 8/2

The application of a cartographic grid network of coordinates for the solution of certain geophysical problems associated with the plotting of fields for meteorological and hydrological magnitudes in Polar areas is discussed, and the method is illustrated with corresponding charts and tables of the transformed coordinate system. Author (GRA)

N71-28455# New York Univ., N.Y. Geophysical Sciences Lab.
CALCULATION OF INFRARED FLUX AT THE SEA SURFACE
Ming-Dah Chow Jan. 1971 49 p refs
(Contracts N00014-67-A-0467-0012; Nonr-285(57))
(AD-722036; GSL-TR-71-1) Avail: NTIS CSCL 4/2

To calculate the infrared flux at the air-sea interface, the radiative transfer equations have been solved numerically. The dependencies of the transmissivity of the atmosphere on pressure, temperature and optical length derived by Davis and Viezee (1964) are used. The sea surface is trated as non-black. Flux emittance and flux reflectance are calculated as functions of the sea surface temperature and its roughness. The values of flux emittance of the sea surface range from 0.928 for a calm, cold sea to 0.937 for a very rough, warm sea. The values of flux reflectance of the sea surface range from 0.037 for a very rough sea and hot, humid air to 0.049 for a calm sea and cool, dry air. Author (GRA)

N71-28498# Space Disturbances Lab., Boulder, Colo.
SPECIES DENSITIES IN THE LOWER THERMOSPHERE COMPATIBLE WITH US STANDARD ATMOSPHERE
Gene W. Adams (Colo. Univ.) Oct. 1970 28 p refs
(COM-71-50004; NOAA-TR-ERL-193-SDL-20) Avail: SOD $0.30; NTIS

The O2, N2, and O number density profiles have been constructed in the 80-120 km region compatible with the U.S. Standard Atmosphere, 1962, and the U.S. Standard Atmosphere Supplements, 1966. Profiles have been constructed at 15, 30, 45, and 60 degrees N, for winter, summer, and spring/fall. Author (GRA)

N71-28499# Naval Oceanographic Office, Washington, D.C.
WINTER COOLING OF ARCTIC FIELDS
A. A. Drogaitsev 1971 24 p refs Transl. into ENGLISH from Probl. Severa (USSR), no. 1, 1958 p 42-51
(AD-720148; NOO-Trans-72) Avail: NTIS CSCL 8/12

The crystallization heat given off by the ice to the atmosphere and its effect on meteorological conditions in the Arctic is analyzed on the basis of observational data and theoretical computations. In connection with this, the interrelation of winter cooling and iciness is brought into discussion with a view to evaluating the prospects of forecasting ice conditions on the Northern Sea Route for the coming navigational season. Author (GRA)

N71-28508*# Maryland Univ., College Park. Dept. of Physics and Astronomy.
ELECTRON HEATING PROCESSES IN THE MIDDLE IONOSPHERE
Tieh Chun Chang (Ph.D. Thesis) Aug. 1970 106 p refs
(Grants NGR-21-002-057; NGR-21-002-008)
(NASA-CR-119031; TR-71-009) Avail: NTIS CSCL 04A

The equilibrium distribution functions for electrons in the ionospheric plasma were calculated for the energy interval of 0 - 15 ev, utilizing data collected in a pulse probe experiment. By using the densities and characteristic temperatures of superthermal and thermal electrons, the electron heat input rates were calculated to be between 3 x 1,000 ev/cu cm-sec and 1.5 x 10,000 ev/cucm-sec in the altitude range between approximately 120 and 240 km. The correlation between the electron heat input rates and the heat loss rates in this altitude range has been studied. The equilibrium energy distributions of the secondary electrons in the middle ionosphere by solar ionizing radiation were calculated for electrons with energies less than 15 ev. A high energy electron distribution (E > or = 15 ev) contributes the retarded probe current which appears to be a linear function of the retarding probe potential. Author

N71-28608# RAND Corp., Santa Monica, Calif.
POSSIBLE EFFECTS OF ATMOSPHERIC PARTICLES ON FIREBALL EMISSIONS
Hal A. Ory and Forrest R. Gilmore Feb. 1971 19 p refs
(Contract DASA01-71-C-0012)
(AD-722031; R-669-DASA; DASA-2812) Avail: NTIS CSCL 4/1

In order to investigate the possible effects of natural atmospheric particles on fireball emission, the available data on particle distribution in the atmosphere are used to calculate the mass fraction as a function of altitude for sulfate particles and particles of meteoritic origin. For altitudes below 20 km the mass fraction of sulfate particles is 10 to the -10 power to 10 to the -9 power above 20 km, the mass fraction decreases rapdily with altitude. The mass fraction of SO2 vapor is probably more than on order of magnitude greater, based on observations at low

altitudes. The meteoritic mass fraction shows practically no altitude dependence, and is approximately 1.3 × 10 to the -10 power over the entire range of interest. Based on a simple thermodynamic model, the mass of meteoritic material vaporized in a fireball is less than half a pound per megaton of bomb yield. Within the limitations of the data used in the calculations, the following conclusions are reached concerning possible effects of atmospheric particles on fireball emission. The contribution of sulfate particles is probably negligible compared with that of atmospheric SO2 vapor, which itself has negligible effect. The contribution of meteoritic particles is negligible compared with that of bomb debris material. Author (GRA)

N71-28609# Environmental Science Services Administration, Boulder, Colo. Earth Sciences Lab.

NORSAR MICROSEISMS

James N. Murdock and John H. Pfluke Jul. 1970 111 p refs

(ARPA Order 800)

(AD-720047; ESSA-TR-ERL-176-ESL-9) Avail: SOD $1.75 CSCL 17/10

Spectral density and coherence estimates, depicting seismic noise recorded at the Norway Seismic Array by the Earthquake Mechanism Laboratory, show the following for the P signal band: the difference between the surface microseism field and that sensed in a 60-m well is normally less than 1 dB, even at times of high wind velocities; the coherence between adjacent subarray sensors is quite small. The coherence of microseisms, particularly at frequencies of 0.1 to 0.6 Hz, shows a strong azimuthal dependency. At lower frequencies, the estimated coherence is greatest in the direction of apparent propagation, perhaps indicating that the noise field is a propagating interference pattern. A mathematical model of the coherence of the postulated interference process agrees qualitatively with the observations. Analog and digital estimates, produced to describe the time-varying microseism trends, demonstrate that the noise field is approximately space stationary at the eight center subarrays. Author (GRA)

N71-28622# Geological Survey, Denver, Colo.

A COMPUTER PROGRAM TO TRACE SEISMIC RAY DISTRIBUTION IN COMPLEX TWO-DIMENSIONAL GEOLOGICAL MODELS Final Report

Nazieh K. Yacoub and James H. Scott (Bureau of Mines) 1970 76 p refs

(PB-197583; USGS-GD-71-002) Avail: NTIS CSCL 08K

A computer program has been developed to trace seismic rays and their amplitudes and energies through complex two-dimensional geological models, for which boundaries between elastic units are defined by a series of digitized X-, Y-coordinate values. Input data for the program includes problem identification, control parameters, model coordinates and elastic parameter for the elastic units. The program evaluates the partitioning of ray amplitude and energy at elastic boundaries, computes the total travel time, total travel distance and other parameters for rays arising at the earth's surface. Instructions are given for punching program control cards and data cards, and for arranging input card decks. An example of printer output for a simple program is presented. The program is written in FORTRAN 4 language. The listing of the program is shown with an example output from a CDC-6600 computer. Author (GRA)

N71-28623# Massachusetts Inst. of Tech., Cambridge.

OCEANOGRAPHIC RESEARCH AT MIT IN THE DEPARTMENT OF EARTH AND PLANETARY SCIENCES AND THE DEPARTMENT OF METEOROLOGY Annual Report, 1 Jan.–31 Dec. 1970

Robert C. Beardsley, Shawn Biehler, Frederick A. Frey, Delbar P. Keily, Erick Mollochristensen et al Mar. 1971 65 p refs

(Contracts Nonr-1841(74); N00014-67-A-0204-0024; Grant NSF GA-23339)

(AD-722019; Rept-71-2) Avail: NTIS CSCL 8/3

Contents: Ocean-island interaction; Ocean circulation model studies; Equatorial undercurrent studies; Ocean bottom pressure fluctuations; One-shot float program; Internal waves and currents; Inertial techniques; Marine gravity; Mechanics of bottom sediment movement; Geochemistry of Mid-Atlantic Ridge sediments; Geophysical tests of petrological models of the spreading lithosphere; Modeling sea floor structure; Deep ocean magnetotelluric program; Heat flow studies and Dynamics of small scale processes in air-sea interaction. GRA

N71-28762# Space Disturbances Lab., Boulder, Colo.

INSTRUMENTATION OF SMALL ROCKETS FOR POLAR CAP ABSORPTION STUDIES

J. S. Heslett, D. F. Wasmundt, L. R. Megill, G. W. Adams, and J. H. Taylor Dec. 1970 20 p refs

(COM-71-50002; NOAA-TR-ERL-190-SDL-19) Avail: SOD $0.35; NTIS CSCL 04A

The instrumentation of small sounding rockets for scientific experiments in the region from 50 km to approximately 110 km is described. These particular rockets were developed to measure the diurnal variations of proton spectra and electron densities during solar proton events. Seven rockets were flown with each carrying a three-channel proton spectrometer and a three-frequency Faraday rotation experiment. The proton spectrometer and Faraday rotation experiment are discussed in some detail. Because of difficulties experienced with the telemetry, considerable telemetry development had to be done. In particular the report mentions modifications of the rocket antenna system, the voltage controlled oscillators, and the modification of a parametric amplifier for use with the Ft. Churchill range telemetry. Author (GRA)

N71-28763# National Oceanic and Atmospheric Administration, Boulder, Colo. Earth Sciences Labs.

HIGH PRECISION PROFILING WITH A RUBIDIUM MAGNETOMETER PAIR

W. P. Hasbrouck Nov. 1970 20 p refs

(COM-71-50003; NOAA-TR-ERL-192-ESL-14) Avail: SOD $0.30; NTIS CSCL 08N

Reliable mapping of quasi-static total magnetic field changes to 0.1 gamma between stations separated by 1/2 km can be accomplished by use of a special paired rubidium magnetometer technique. The limitations on profiling accuracy imposed by the intrinsic reproducibility of a rubidium horizontal gradiometer are discussed. It then described a pier-differencing method of traversing which has been used to overcome this insufficiency and which has produced long-spaced station-to-station results of tenth gamma reliability. Nonlinear instrumental drift between the paired sensors is minimized by use of a differential drift correction. Examples show how this correction is computed and applied. Author (GRA)

N71-28764# Coast and Geodetic Survey, Rockville, Md.

A COMPARISON OF METHODS FOR COMPUTING GRAVITATIONAL POTENTIAL DERIVATIVES

L. J. Gulick Sep. 1970 38 p refs

(COM-71-00185; ESSA -TR-CGS-40) Avail: SOD $0.40; NTIS CSCL 08E

Computation of the derivatives of the gravitational potential of the earth using spherical harmonics requires the formation of a number of double sums. The expression of these double sums is the most important consideration for achievement of maximum efficiency. Three methods of computing the derivatives are compared for efficiency, and it is found that the double sums are most efficiently computed using polar coordinates with subsequent transformation of the derivatives to rectangular coordinates by simple application of the chain rule. A subroutine using this method uses less than 700 words of central memory and requires only 7.3 milliseconds for execution on the CDC 6600 computer when harmonic coefficients up to degree and order 14 are used. Author (GRA)

N71-28798# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
ALGORITHM TO COMPUTE TROPOSPHERIC REFRACTION EFFECTS ON RANGE MEASUREMENTS
S. M. Yionoulis Jul. 1970 13 p refs
(Contract N00017-62-C-0604)
(AD-721333; APL-TG-1125) Avail: NTIS CSCL 4/1

H. S. Hopfield has modeled a two-quartic tropospheric refractivity profile for correcting satellite range and range rate data which treats the dry and wet components of the tropospheric refractivity separately. The expression given for computing the contributions to range data is sensitive to rounding errors at high elevations even when evaluated in double precision. Alternate forms of the solution are presented here which eliminate the problem of rounding errors and the need for double precision computation. They allow the user to benefit from the full accuracy of Mrs. Hopfields model for all elevations. Author (GRA)

N71-28853# National Oceanic and Atmospheric Administration, Washington, D.C. Federal Coordinator for Meteorological Services and Supporting Research.
FEDERAL PLAN FOR AIR POLLUTION CONTROL METEOROLOGICAL SERVICE: TO SUPPORT FEDERAL, STATE, AND LOCAL AIR POLLUTION CONTROL AGENCIES
Jan. 1971 27 p
(COM-71-00200; NOAA-71012801) Avail: NTIS CSCL 13B

The needs of federal, state, and local air pollution control agencies for specialized meteorological support are investigated. Agency responsibilities, service concepts, and a 5-year program directed toward providing improved services to these users are described. Author (GRA)

N71-28856*# Translation Consultants, Ltd., Arlington, Va.
ULTRASONIC PULSE INVESTIGATIONS IN THE KRIVOY ROG IRON ORE MINES [IMPULSNYYE ULTRAZVUKOVYYE ISSLEDOVANIYA V ZHELEZORUDNYKH SHAKHTAKH KRIVOGO ROGS]
V. V. Kravets et al Washington NASA Jun. 1971 19 p refs Transl. into ENGLISH from Geoakustika (Moscow), 1966 p 166-177
(Contract NASw-2038)
(NASA-TT-F-13656) Avail: NTIS CSCL 08I

The use of the ultrasonic method in ore mines to study the physical and mechanical properties of rocks, and of their relationships in terms of pressure, and of changes in the condition of the in place ore during mining operations is discussed. The methodology used to find the velocity of elastic waves in the deposit is developed, and data on the velocity of such waves are presented. Author

N71-28864# Military Research and Development Center, Bangkok (Thailand).
IONOXPHERIC DATA REPORT, AUGUST 1970
Aug. 1970 38 p
(AD-720326; MRDC-70-008) Avail: NTIS CSCL 4/1

Ionospheric observations are being carried out at the Operations Room, Vertical-Incident Sounder Site, located at the Applied Scientific Research Corporation of Thailand, Bangkok 9, Thailand. Data are being taken with a modified model C-2 Vertical-Incident Sounder. Author (GRA)

N71-28865# Military Research and Development Center, Bangkok (Thailand)
IONOSPHERIC DATA REPORT, SEPTEMBER 1970
Sep. 1970 37 p
(AD-720327; MRDC-70-009) Avail: NTIS CSCL 4/1

Ionospheric observations are being carried out at the Operations Room, Vertical-Incident Sounder Site, located at the Applied Scientific Research Corporation of Thailand, Bangkok 9, Thailand. Data are being taken with a modified model C-2 Vertical-Incident Sounder. Author (GRA)

N71-28866 National Lending Library for Science and Technology, Boston Spa (England).
FLUCTUATIONS OF THE TOTAL OZONE CONTENT OF THE ATMOSPHERE IN CONNECTION WITH STRATOSPHERIC WARMINGS
W. Hoebbel 24 Jun. 1970 9 p refs Transl. into ENGLISH from Met. Dienst DDR, 75 Jahre Met. Obs. Potsdam 1892-1967 (Potsdam), 1969 p 108-111
(NLL-M-9270-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Monthly means of total ozone content averaged over all stations in the Northern Hemisphere were always greater in magnitude in years in which there was a late final warming than in years with an early warming. A relationship between motion direction of sudden stratospheric temperature change regions and wind direction at the equatorial region and a high total ozone content over the Northern Hemisphere is established. G.G.

N71-28867*# Translation Consultants, Ltd., Arlington, Va.
CHANGE IN THE ELASTIC PARAMETERS AND STRENGTH OF ROCKS UNDER PRESSURE [OB IZMENENII UPRUGIKH PARAMETROV I PROCHNOSTI GORNYKH POROD POD DEYSTVIYEM DAULENIYA]
Z. I. Stakhovskaya Washington NASA Jun. 1971 8 p refs Transl. into ENGLISH from the publ. 'Problemy Mekhaniki Gornykh Porod; Vsesoyuznoy Nauchnoy Konferentsii, 1st' Alma-Ata, 1965 p 394-398
(Contract NASw-2038)
(NASA-TT-F-13653) Avail: NTIS CSCL 08G

Models are used to demonstrate the effect porosity in rocks has on change in elastic parameters when rocks are subjected to high uniform pressures. It is shown that the change can be found by knowing the relationship between areas of contacts and units strain, and that this latter relationship can be found by using certain formulas and curves, both of which are included. Author

N71-28874# Space Disturbances Lab., Boulder, Colo.
A SATELLITE RECORDING AND DATA BASE SYSTEM
Ralph J. Slutz, Robert B. Doeker, Thomas B. Gray, Jr., Richard N. Grubb, Charles E. Hornback et al Dec. 1970 25 p
(COM-71-00220; NOAA-TM-ERL-SDL-16) Avail: NTIS CSCL 09B

A coherent plan to augment the present data system at the Space Disturbances Laboratory is outlined. The real time capability of the system is discussed along with satellite monitoring, system reliability, and other salient features. Tables of costs and schedule are included. Author (GRA)

N71-28890*# Translation Consultants, Ltd., Arlington, Va.
A METHODOLOGY FOR DETERMINING THE ELASTIC CONSTANTS OF IN-SITU ROCKS [K METODIKE OPREDELENIYA UPRUGIKH KONSTANT GORRYKH POROD V YESTESTVENNOM ZALEGANII]
A. S. Kefeli et al Washington NASA Jun. 1971 12 p refs Transl. into ENGLISH from the publ. 'Problemy Mekhaniki Gornykh Porod; Vsesoywznoy Konferentsii, 1st' Alma-Ata, 1965 p 201-207
(Contract NASw-2038)
(NASA-TT-F-13654) Avail: NTIS CSCL 08G

Seismic methods are used to study in situ rocks to determine their elastic constants for engineering and geological surveys.

Research proved that the velocities of elastic waves depend on isotropic compression, the presence of entrapped air in the soil, the degree to which the soil is saturated with water, and a number of other factors. E.M.C.

N71-28973*# Scientific Translation Service, Santa Barbara, Calif.
ON THE CONNECTION BETWEEN THE ELECTRICAL AND ELASTIC PROPERTIES OF SEDIMENTARY ROCKS OF SOUTHERN EMBA AND MANGYSHLAK [O SVYAZI MEZHDU ELEKTRICHESKIMI I UPRUGIMI SVOISTVAMI OSADOCHNYKH POROD YUZHNOI EMBY I MANGYSHLAKA]
A. B. Li et al Washington NASA Jun. 1971 15 p refs Transl. into ENGLISH from Izv. Akad. Nauk Kaz. SSR Seri Geol. (USSR), no. 5, 1969 p 73–81
(Contract NASw-2035)
(NASA-TT-F-13706) Avail: NTIS CSCL 08G

The connection between the electrical and elastic properties of sedimentary rocks is discussed; basic factors determining electrical conductivity in such rocks are identified; and the methodology used in measurement of electrical resistance in samples from the Mangyshalak and southern Emba regions of the U.S.S.R. is described in detail. The establishment of a relationship between the electrical and elastic properties is significant, because it allows the construction of a detailed velocity profile of large amounts of material gathered by electrocoring techniques for use in interpreting seismological prospecting data. The assumption that such a relationship exists is based on the fact that both properties are functions of density and porosity. Formulas can then be developed to obtain specific electrical resistances of layers of rock. Samples of sandstone, clay and argillite from the two regions were analyzed under laboratory conditions, and their electrical resistance and the propagation rate of longitudinal elastic waves were measured. Following accumulation of a large volume of experimental values for these properties, their relationship was plotted and layer velocity profiles obtained. Theoretical implications of this new method for industrial/geophysical research are suggested. A.C.R.

N71-28974*# Translation Consultants, Ltd., Arlington, Va.
ULTRASONIC INVESTIGATION OF THE VELOCITY OF ELASTIC WAVES IN POROUS SEDIMENTARY ROCKS [UL'TRAZVUKOVYYE ISSLEDOVAIYA SKOROSTEY UPRUGIKH VOLN V PORISTYKH OSADOCHNYKH PORODAKH]
G. I. Petkevich Washington NASA Jun. 1971 11 p refs Transl. into ENGLISH from Akad. Nauk SSSR Inst. Fiz. Zemli, Sovet Po Geofiz. (Moscow), 1966 p 119 124
(Contract NASw-2038)
(NASA-TT-F-13655) Avail: NTIS CSCL 08G

Results of investigation of the role of solid and liquid phases in the elasticity of porous rocks are described. Experiments included measurement of the velocities of ultrasonic waves in liquids and in porous rock specimens containing a fluid; analysis of the formulas used to find velocities of elastic waves in two-phase media; comparison of theoretical and experimental data; and an evaluation of the effect of solid and liquid phase properties on the velocity of elastic waves in a porous medium. Author

N71-29116 National Lending Library for Science and Technology, Boston Spa (England).
THE 500 mb HEIGHT FIELD IN THE NORTHERN HEMISPHERE IN NATURAL SYNOPTIC SEASONS
N. M. Zaherova 24 Jun. 1970 30 p refs Transl. into ENGLISH from Tr. Gidrometeorol. Nauchn.-Issled. Tsentr. SSSR (Leningrad), no. 43, 1969 p 23–56
(NLL-M-9266-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 3 NLL photocopy coupons

In an attempt to discover regularities in the natural synoptic (n.s.) seasons, research over the past 30 years is reviewed, and special features of the 500 mb height field for the Northern Hemisphere are established. The computation of seasonal characteristics was accomplished by computer techniques, and data are reported for the following specific attributes of atmospheric circulation: (1) long term values of H-500 over the Northern Hemisphere during the n.s. seasons; (2) changes of H-500 from one season to the next; (3) ranges of H-500 seasonal values; and (4) H-500 standard deviation over the period covered. A.C.R.

N71-29175 National Lending Library for Science and Technology, Boston Spa (England).
THE RELATIONSHIP BETWEEN THE ALBEDO OF THE WATER SURFACE OF SMALL LAKES AND THE CHROMINANCE AND TRANSPARENCY OF THE WATER MASS
G. M. Bagrova 24 Jun. 1970 8 p refs Transl. into ENGLISH from Izv. Vses. Geog. Obsc. (Moscow), no. 101, 1969 p 70–74
(NLL-M-9264-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Results are analyzed of experimental work conducted on the albedo of the water surface of small lakes in different climatic and topographical conditions to determine how albedo is related to the chrominance and transparency of the water mass. Experiments conducted on lakes in various regions of the Soviet Union indicated that transparency plays a much greater part than chrominance in the variation of albedo. As transparency increases, albedo decreases. At solar elevations of 35 to 45 deg, albedo falls by 4.6% as transparency changes from 0 to 5m. As solar elevation decreases, albedo differences increase to 5.5 to 6.7%. A.L.

N71-29178 National Lending Library for Science and Technology, Boston Spa (England).
THE NATURE OF THE SEMICIRCULAR CYCLE IN THE TROPOSPHERE
V. F. Loginov 24 Jun. 1970 10 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 245, 1969 p 25–30
(NLL-M-9271-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The relationship between the secular cycle of solar activity and the tropospheric processes is discussed. It has been determined that maximum and minimum solar activity in the secular cycle correspond to the same tropospheric process level. Regions of the high latitudes of the northern hemisphere were selected for the investigation because of the great variations in atmospheric circulation and climate. The index of geomagnetic disturbance was used as the basis for determining the extent of solar activity. P.N.F.

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N71-28017*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
INSTRUMENTATION REQUIREMENTS FOR A FLIGHT REENTRY HEATING EXPERIMENT AT INTERPLANETARY RETURN VELOCITY
Elden S. Cornette and Edward M. Sullivan Washington Jun. 1971 46 p refs
(NASA-TN-D-6265; L-7574) Avail: NTIS CSCL 14B

A study has been made of the flight instrumentation

requirements for a ballistic entry simulation of the return of a blunt reentry vehicle from interplanetary flight. It is proposed that total (radiative plus convective) heating rates be measured and that the radiative heating rates be deduced from spectral radiation intensity measurements made with a radiometer mounted inside the spacecraft. Other instrumentation requirements and problem areas involved in the inflight measurement of the heating environment and heat shield response are discussed. Areas are pointed out where further development of flight instrumentation and data analysis techniques will be required if the flight experiment is to achieve all proposed experimental objectives. Author

N71-28025*# Research Triangle Inst., Durham, N.C. Engineering and Environmental Sciences Div.

THE INFLUENCE OF SPACE RADIATION UPON THE MOS MICROMETEOROID CAPACITOR DETECTOR Final Report, 17 Jul. 1970 - 16 Feb. 1971

L. K. Monteith, R. P. Donovan, and M. Simons Feb. 1971 55 p refs

(Contract NAS1-10232)

(NASA-CR-111892) Avail: NTIS CSCL 14B

Four possible failure modes due to electron irradiation are spurious output generated by photocurrents, spurious output due to accumulation of space charge in the oxide, spurious output because of spontaneous discharge of space charge in the oxide, and detector failure because of increased capacitor leakage current. The first two are discussed and dismissed as negligible. A spontaneous discharge is not likely to create a signal of sufficient magnitude to trigger the counting circuit if only the space charge within the oxide participates in the spontaneous discharge. Complete discharge is unlikely to occur through a small localized region; a more probable failure mechanism is for the spontaneous discharge to initiate a capacitor discharge, which would be indistinguishable from a capacitor discharge triggered by a micrometeoroid count. The capacitors can also be rendered inoperative by greatly increased leakage current because of radiation-induced degradation of the oxide or oxide-silicon interface. Two experiments recommended to assure reliability and accuracy of the detector output are irradiation of a biased detector with 20 keV electrons to maximize space charge buildup and with 300 keV electrons to induce displacement damage. Author

N71-28069*# Techtran Corp., Glen Burnie, Md.

PROCESS FOR PRODUCTION OF X-RAY INTENSIFYING FILMS [VERFAHREN ZUR HERSTELLUNG VON ROENTGENVERSTAERKERFOLIEN]

Hans Plapperer et al Washington NASA May 1971 7 p Transl. into ENGLISH of East German Patent No. 60229, Feb. 1968 3 p

(Contract NASw-2037)

(NASA-TT-F-13671) Avail: NTIS CSCL 14E

A method for casting a high concentration of X-ray intensifier in a low percentage of gelling agent(s) to form a uniform film deposit is described. The process can be automated and requires little or no highly-volatile solvent. Author

N71-28070# Stevens Inst. of Tech., Hoboken, N.J. Dept. of Chemistry.

STEADY STATE AND TRANSIENT SHEAR STRESS MEASUREMENTS WITH BICONICAL RHEOMETER

K. J. Madonia and C. G. Gogos 22 Mar. 1971 21 p refs Submitted for publication

(Contract N00014-68-A-0131)

(AD-721379; ONR-TR-27) Avail: NTIS CSCL 7/4

A Biconical Rheometer, designed to operate at constant shear rate in the range of 0.0001 to 100/sec, is capable of determining the apparent viscosity as a function of time for polymer melts. An enclosed sample cavity eliminates the air-polymer interphase; thus, there is no polymer melt fracture to limit the shear rate range. The instrument is equipped with a stiff torque transducer and a clutch-brake unit for the instantaneous shear application necessary in transient polymer response studies. Air suspension bearings make the instrument virtually frictionless and interchangeable torque transducers provide the capability for stress relaxation studies after cessation of flow. Transient and steady-state results for a family of narrow distribution polystyrenes are included to demonstrate the ability of the Rheometer. Author (GRA)

N71-28237# Technische Hogeschool, Delft (Netherlands) Afdeling der Technische Natuurkunde.

IMAGING PROPERTIES OF DIFFRACTION GRATINGS

Wilhelmus Werner (Ph.D. Thesis) Jan. 1970 86 p refs

Avail: NTIS

A description is given of the spectral image formed by a reflecting diffraction grating with straight equidistant grooves. The parameters of this image, being the narrowest constriction of the diffracted beam, are defined by applying Fermat's principle to the Hamiltonian characteristic function. ESRO

N71-28245# Technische Hogeschool, Delft (Netherlands) Afdeling der Technische Natuurkunde.

CORRECTION OF SPHERICAL ABERRATION

Nicolaas Henricus Dekkers (Ph.D. Thesis) 1969 100 p refs

Avail: NTIS

The correction of magnetic lens spherical aberration in electron microscopes is investigated. A theory is developed which describes the effect of a current-carrying corrector for this spherical aberration. The utilization of a superconducting thin film ring inside a lens is proposed and tested. ESRO

N71-28269# Technische Hogeschool, Delft (Netherlands) Afdeling der Technische Natuurkunde.

A SELF-REDUCING RANGE-FINDER WITH AN AUTOMATIC REGISTRATION SYSTEM

Matthijs Johannes Martinus Bogaerts (Ph.D. Thesis) Jun. 1969 110 p refs

Avail: NTIS

A self-reducing optical geodetic range finder for measuring both reduced and unreduced distances, height differences, and bearings, is described. The measured data are automatically registered on magnetic cassete-recorder tape. The electronics necessary for the transfer of data from tape to punched cards are reviewed as well as four computer programs for conversion of these data to automatic survey mapping. ESRO

N71-28309# Pennsylvania State Univ., University Park. Ordnance Research Lab.

A LASER INTERFEROMETER TECHNIQUE FOR MEASURING SOUND HARMONIC DISTORTION IN THE ACOUSTIC OUTPUT OF A TRANSDUCER

Dennis D. Doughty 27 Mar. 1970 73 p refs

(Contract N00017-70-C-1407)

(AD-721721; TM-681-02) Avail: NTIS CSCL 14/2

A Michelson laser interferometer technique is developed to measure the second harmonic distortion in the acoustic output of a transducer. The only prerequisites to such a technique is that the fundamental displacement be no larger than 2000A, and that the second harmonic displacement be at least 20 dB less than the fundamental. Measurements were taken to prove the feasibility of such a technique. A transducer was driven with a simulated distorted signal by driving the transducer with a 1 kHz and 2 kHz mixed signal supplied by two audio oscillators. The displacement measured at both frequencies agreed well with those displacements determined by two other independent methods. The two other independent methods used to verify the measurements were (1) measurements taken optically using a laser interferometer while the

transducer was vibrating at one frequency only, and (2) displacements that were calculated using the specification sheets provided with the transducer. Author (GRA)

N71-28330*# Consolidated Controls Corp., Bethel, Conn.
PRESSURE MEASURING SYSTEMS FOR CLOSED CYCLE LIQUID METAL FACILITIES Final Report
Anthony J. Cassano 30 Apr. 1971 403 p refs
(Contract NAS3-4170)
(NASA-CR-72886) Avail: NTIS HC$6.00/MF$0.95 CSCL 14B

The development of a pressure transducer providing accurate measurements in the liquid, vapor, and two-phase streams of a potassium loop operating at temperatures up to 1800 F is described. In addition to potassium, the transducer may also find use in loops containing sodium, lithium, cesium or rubidium. The transducer uses a thermionic diode sensor to convert the motion of a pressure-actuated refractory alloy capsule into a suitable electrical output. Author

N71-28497# Army Electronics Command, Fort Monmouth, N.J.
A SENSITIVE, LOW-FIELD INCREMENTAL MAGNETOMETER FOR USE FROM ROOM TO LIQUID HELIUM TEMPERATURES
R. L. Ross Feb. 2, 1971 16 p refs
(AD-721590; ECOM-3395) Avail: NTIS CSCL 14/2

A phase sensitive detector and commercial Hall probe are combined with a control current amplifier to provide a sensitive, low-field incremental magnetometer for use from room to liquid helium temperatures. Methods for cancellation of the zero-field Hall voltage are discussed. A field resolution of 7 milligauss in an ambient field of 10 gauss has been obtained. The Hall probes characteristic was found to be extremely linear over the 0 to 10 gauss low-field range and decreased slightly in sensitivity at 4.2K. Author (GRA)

N71-28511*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
SOME FACTORS AFFECTING THE ACCURACY OF A SPACE-BORNE ASTRONOMICAL TELEVISION PHOTOMETER
Yasushi Nozawa and Robert J. Davis *In* Princeton Univ. Astron. Use of Television-Type Image Sensors 1971 p 13-26 refs (See N71-28509 16-30)
(Contract NAS5-1535)
Avail: NTIS CSCL 14B

The basic sources of system inaccuracies in the celescope experiment are described, and useful information for future similar work is provided. A total system accuracy of approximately 40% was obtained. The primary sources of error were considered to be inaccuracies in calibration, and the mathematical model of the changes in sensitivity under orbital conditions. A total-system concept and system-modification cycles are presented with a description of the celescope experiment. It is concluded that the largest error was the result of an inaccurate mathematical model of the hardware characteristics, which was caused by an insufficient number of calibration points and inaccurate assumptions concerning operating conditions. F.O.S.

N71-28512*# Princeton Univ. Observatory, N.J.
DEVELOPMENT OF THE SEC VIDICON FOR ASTRONOMY Progress Report
P. M. Zucchino and J. L. Lowrance *In* Princeton Univ. Astron. Use of Television-Type Image Sensors 1971 p 27-54 refs (See N71-28509 16-30)
Avail: NTIS CSCL 14B

The work to develop a sensor for space astronomy applications, especially diffraction limited imagery and high-resolution spectroscopy is reported. Ground based applications were included in the development program, both to exploit the intrinsic capabilities of integrating television tubes for certain ground based observational work and to gain application experience with television for actual astronomy observational tasks. The primary sensor characteristics that are relevant to the basic choice of a sensor are: (1) a capability for exposure periods of the order of 10 hours, (2) a modulation transfer function of at least 0.5 at 10 cycles/mm over an image format of at least 250,000 image elements, that is, a 25 mm square, (3) stable photometric and geometric transfer functions, and (4) good quantum efficiency with a quantum noise limited signal to noise ratio over most of the dynamic range. Author

N71-28513*# Naval Research Lab., Washington, D.C. E. O. Hulburt Center for Space Research.
SEC VIDICONS AS DETECTORS IN DIGITIZED PHOTOMETRIC IMAGE-FORMING SYSTEMS FOR ASTRONOMICAL OBSERVATIONS FROM THE GROUND AND SATELLITES
G. E. Brueckner and B. J. Tucker (Electro-Mechanical Res., Inc., Princeton, N.J.) *In* Princeton Univ. Astron. Use of Television-Type Image Sensors 1971 p 55-76 (See N71-28509 16-30)
Avail: NTIS CSCL 14B

Two image-forming photometric systems using SEC vidicons are reported: a digitized SEC vidicon system designed to map and measure the intensity of the outer solar corona from an OSO spacecraft, and a digitized SEC vidicon system designed to measure absorption line polarization in the visible spectrum of the sun and to map solar magnetic fields. The advantages of the SEC vidicon over other detectors for these applications are discussed, including integration and storage of low-light level pictures and high accuracy differential measurements. The limitations of SEC vidicons and the various noise sources are discussed and the first laboratory test results are shown. Author

N71-28515*# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
SINGLE PHOTOELECTRON RECORDING BY AN IMAGE INTENSIFIER TV CAMERA SYSTEM
S. B. Mende *In* Princeton Univ. Astron. Use of Television-Type Image Sensors 1971 p 85-106 refs (See N71-28509 16-30)
Avail: NTIS CSCL 14E

The performance of the image intensifier plumbicon camera as a single photoelectron counter is reviewed. The system is described, and the general and statistical performance are discussed. It is concluded that the system works well as a detector of single photoelectrons. The major problems in using it as a quantitative counter come from the fact that TV systems work by generating equal lines and frames both spatially and temporally, whereas photoelectrons occur as random events. F.O.S.

N71-28517*# Naval Research Lab., Washington, D.C. E. O. Hulburt Center for Space Research.
MICROCHANNEL INTENSIFIER VIDICON FOR FAR-UV IMAGING
George R. Carruthers *In* Princeton Univ. Astron. Use of Television-Type Image Sensors 1971 p 109-116 refs (See N71-28509 16-30)
Avail: NTIS CSCL 14B

The microchannel intensifier-vidicon camera under development at the NRL is described for far UV imaging. Incoming light is imaged by a Schmidt optical system onto an opaque alkali-halide photocathode, which is deposited on the focal surface. Electrons emitted by the photocathode, which is maintained at a high negative voltage, are accelerated toward the primary mirror, which is maintained at ground potential, and are simultaneously focused by an axial magnetic field produced by the surrounding magnet. The electron image is formed on the front face of the microchannel plate; this image is preserved while the incident electrons are

multiplied in passing through the microchannel plate. These amplified electrons are then re-imaged onto a phosphor screen using a conventional electromagnetic imaging section. Light emitted by the phosphor is then conducted by fiber optics to the photosensitive surface of a conventional vidicon camera tube. Author

N71-28518*# Lick Observatory, Mount Hamilton, Calif. Board of Studies in Astronomy and Astrophysics.
THE RESPONSE OF PHOSPHOR OUTPUT IMAGE INTENSIFIERS TO SINGLE PHOTON INPUTS
John McNall, Lloyd Robinson, and E. Joseph Wampler *In* Princeton Univ. Astron. Use of Television-Type Image Sensors 1971 p 117-128 refs (See N71-28509 16-30)
(Contract NAS5-1348; Grants NGL-05-061-008; NSF GP-6310)
Avail: NTIS CSCL 14B

The development of a multichannel spectrophotometer for faint optical sources which required an investigation of the single-photon response of image intensifiers was studied. Tests of intensifiers with fiber optics face-plates show that it should be possible to construct a spectrophotometer that uses the storage properties of the output phosphor to provide pulse-counting operation in several hundred simultaneous channels. Author

N71-28522*# California Univ., San Diego. Scripps Inst. of Oceanography.
IMAGE RESTORATION TECHNIQUES APPLIED TO ASTRONOMICAL PHOTOGRAPHY
B. L. McGlamery *In* Princeton Univ. Astron. Use of Television-Type Image Sensors 1971 p 167-192 refs (See N71-28509 16-30)
(Contract F08606-68-C-0017; ARPA Order 1062)
Avail: NTIS CSCL 14E

Image processing techniques are described which can be used to process astronomical images whose principal degradation is caused by atmospheric turbulence. The purpose of the processing is to extract information from the degraded image or images which cannot be extracted by the unaided human visual system. Author

N71-28524*# Princeton Univ. Observatory, N.J.
IMAGE PROCESSING OF STRATOSCOPE PHOTOGRAPHS
R. E. Danielson and M. G. Tomasko *In* Princeton Univ. Astron. Use of Television-Type Image Sensors 1971 p 199-206 refs (See N71-28509 16-30)
Avail: NTIS CSCL 14E

Image restoration is studied for processing Stratoscope 2 photographs and photographs by orbital telescopes. The photographic enhancement procedures are illustrated by high quality photographs of a sunspot by Flight 1959-D. F.O.S.

N71-28587# ARO, Inc., Arnold Air Force Station, Tenn.
EVALUATION OF A PRESSURE GAGE ROTATING IN A MOLECULAR FLUX Final Report, 1 Jul. 1969-Jun. 1970
J. D. Haygood and R. Dawbarn AEDC Apr. 1971 68 p refs
(Contract F40600-71-C-0002)
(AD-721672; ARO-VKF-TR-70-274; AEDC-TR-70-287) Avail: NTIS CSCL 14/2

The purpose of this project was to help evaluate data obtained from an ion gage flown on board the OV1-15 satellite. The aerodynamic molecular beam facility was modified to produce a molecular beam with a 5-in.-diam test core. This system was used to determine the effects of a changing angle of attack on the pressure reading in a hot cathode magnetron ionization gage. Static calibrations were made for various orientations of the gage to the beam flow. Dynamic calibrations were made with the gage rotating in the beam flow at approximately 2 rpm. A matrix of correction factors was prepared which may be used to adjust the observed gage reading at a known attitude and azimuth angle to that pressure which would have been observed with the same molecular flux and the gage at 0-deg attitude and 0-deg azimuth. Author (GRA)

N71-28602# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
A SYNCHRONIZED MULTIPLE PULSER FOR PARTICLE DETECTOR SIMULATION
S. A. Gary Aug. 1970 52 p
(Contract N00017-62-C-0604)
(AD-721332; APL-TG-1117) Avail: NTIS CSCL 14/2

A pulse generator has been developed for use with nuclear particle detection systems. The instrument simulates output charge signals obtained from an array of solid-state detectors, providing variable timing delays from 0 to 1000 ns between channels and pulse amplitudes of either polarity up to 100 MeV, referred to a silicon detector. It has been built in both two-channel and three-channel versions. Pulse amplitudes and timing delays are read directly from controls mounted on the instrument face. Amplitude nonlinearity is less than 1% of full-scale on all ranges. Timing accuracy is 2 ns or 2%. The pulse repetition rate is 1000 Hz. Circuit diagrams, photographs, and calibration procedures are included. Author (GRA)

N71-28603# Aktiebolaget Atomenergi, Studsvik (Sweden).
X-RAY POWDER DIFFRACTION WITH GUINIER-HAEGG FOCUSING CAMERAS
Allan Brown 1970 101 p refs
(AE-409) Avail: AEC Depository Libraries

The Guinier-Hagg focusing camera is discussed with reference to its use as an instrument for rapid phase analysis. An actual camera and the alignment procedure employed in its setting up are described. The results obtained with the instrument are compared with those obtained with Debye-Scherrer cameras and powder diffractometers. Exposure times of 15 to 30 minutes with compounds of simple structure are roughly one-sixth of those required for Debye-Scherrer patterns. Coupled with the lower background resulting from the use of a monochromatic X-ray beam, the shorter exposure time gives a ten-fold increase in sensitivity for the detection of minor phases as compared with the Debye Scherrer camera. Attention is paid to the precautions taken to obtain reliable Bragg angles from Guinier-Haegg film measurements, with particular reference to calibration procedures. It is concluded that with proper calibration procedures and least squares treatment of the data, accuracies of the order of 0.005% are attainable. Author (NSA)

N71-28651*# General Dynamics Corp., San Diego, Calif.
MULTIWIRE HIGH TEMPERATURE THERMOCOUPLE Patent Application
James H. Sleigh, Jr. and Donald E. Schwarzer, inventors (to NASA) 12 p Filed 17 Aug. 1970 Sponsored by NASA
(NASA-Case-LEW-10854-1; US-Patent-Appl-SN-64393) Avail: NTIS CSCL 14B

A sheathed thermocouple probe for use in an extremely high temperature environment is described. The probe is made by inserting an end of each of a pair of thermocouple wires into a cavity or passageway in a plug which is then compressed by swaging or the like to squeeze the wires together. BeO beads are then strung on the thermocouple leads and the whole assembly inserted into a cylindrical tube or a sheath. One end of the sheath may be swaged onto the plug, if desired, and the ends may be closed by welding whether or not the plug is swaged into the sheath. NSA

N71-28652# National Bureau of Standards, Washington, D.C. Optical Physics Div.
METHOD OF CALIBRATING WEIGHTS FOR PISTON GAGES

H. E. Almer May 1971 54 p refs
(NBS-TN-577) Avail: SOD $0.55

Direct comparison methods for calibrating piston gage weights for use with both equal-arm balances and single-pan balances are presented. Methods of estimating the uncertainty of the values obtained are given. Also included are methods of checking for blunders or gross errors. Author

N71-28653*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
STAR TRACKING RETICLES AND PROCESS FOR THE PRODUCTION THEREOF Patent Application
Wade O. Smith and Albert R. Toft, inventors (to NASA) 24 p Filed 12 Oct. 1970
(NASA-Case-GSC-11188-1; US-Patent-Appl-SN-80029) Avail: NTIS CSCL 14B

The production of reticles generally having application in outer space is discussed. The reticles are nonreflective and suitable for transmission in the visible and ultraviolet regions. The products are quartz discs coated with a pattern of successive layers of chromium, chromium-silver, silver, copper and black chromium. They are produced by vacuum deposition of the first three layers on the quartz base while utilizing a photoresist prepared mask for a pattern. The copper and black chromium layers are then electrodeposited from conventional electroplating baths. NSA

N71-28654*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A MAGNIFYING SCRATCH GAGE FORCE TRANSDUCER Patent Application
Charles E. Scott, inventor (to NASA) 13 p Filed 17 Feb. 1970
(NASA-Case-LAR-10496-1; US-Patent-Appl-SN-12661) Avail: NTIS CSCL 14B

A passive force transducer for measuring, magnifying, and recording the maximum load occuring on a given specimen being loaded, is described. The transducer was designed to withstand extreme environmental conditions and it has a high natural frequency. NSA

N71-28701# International Atomic Energy Agency, Vienna (Austria).
INSTRUMENTATION FOR NEUTRON INELASTIC SCATTERING RESEARCH Panel Proceedings
1970 299 p refs Conf. held in Vienna, 1–5 Dec. 1969
(STI/PUB/275) Avail: NTIS

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14. UTILIZATION OF NEUTRON GUIDE TUBES FOR NEUTRON INELASTIC SCATTERING B. Jacrot (Inst. Max von Laue/Paul Langevin, Grenoble, France) p 225–247 refs (See N71-28715 16-14)

15. REVIEW OF HOT NEUTRON SOURCES P. A. Egelstaff (UKAEA), Harwell, Engl.) p 249–268 refs (See N71-28716 16-24)

N71-28702# Atomic Energy of Canada, Ltd., Chalk River (Ontario). Nuclear Labs.
A CRITICAL COMPARISON OF TECHNIQUES FOR INELASTIC NEUTRON SCATTERING
A. D. B. Woods, G. Dolling, and R. A. Cowley *In* IAEA Instrumentation for Neutron Inelastic Scattering Res. 1970 p 1–17 refs (See N71-28701 16-14)
Avail: NTIS

The triple axis crystal spectrometer, the conventional chopper/time-of-flight spectrometer, and the correlation chopper spectrometer are evaluated by considering advantages and disadvantages of each spectrometer in relation to: (1) limited regions of the scattering function; and (2) the whole scattering function. It is concluded that almost all types of experiments in group (1) are best performed with the triple axis spectrometer when a steady state neutron source is available. If a pulsed source is available, the conventional chopper is favored for type (2) experiments, and, with provision of adequate on-line data handling facilities, competes successfully with the triple axis crystal spectrometer for many type (1) experiments also. A description is given of four experiments which have been performed both with triple axis crystal spectrometers and conventional chopper/time-of-flight spectrometers. Author

N71-28703# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Festkoerper- und Neutronenphysik.
A COMPARISON OF DIFFERENT INSTRUMENTS WITH RESPECT TO MEASUREMENTS ON LIQUIDS
B. Dornier and H. H. Stiller *In* IAEA Instrumentation for Neutron Inelastic Scattering Res. 1970 p 19–35 refs (See N71-28701 16-14)
Avail: NTIS

For neutron spectroscopic investigations on liquids the use of time-of-flight instruments seems to be preferable in all cases except Brillouin scattering. For Brillouin scattering a three axis spectrometer has the following advantages: (1) smaller scattering angles attainable; (2) free choice of experimental path; and (3) by focusing improved resolution is possible without intensity loss.

Brillouin scattering has been performed in liquid Pb, Bi and Co and in CO2 and CS2. Author

N71-28704# Aktiebolaget Atomenergie, Studsvik (Sweden).
COMPARISON OF NEUTRON-SCATTERING TECHNIQUES WITH REGARD TO RESOLUTION AND INTENSITY
R. Stedman *In* IAEA Instrumentation for Neutron Inelastic Scattering Res. 1970 p 37–47 refs (See N71-28701 16-14)
Avail: NTIS

Monochromators and analyzers are considered with respect to the intensity distribution of neutron momenta. The distribution for a crystal is used as model, and distributions for single channels of other instruments treated by analogy. Various types of experiment are then discussed, and of appropriate spectrometers. It is concluded that for examining the fine structure of phonon and magnon dispersion curves, molecular spectrometry, and small angle scattering the crystal spectrometer is a good instrument, while for liquids TOF analyzers are probably preferable. Author

N71-28705# Atomic Energy Commission Research Establishment, Riso (Denmark).
RESOLUTION OF NEUTRON SPECTROMETERS FOR INELASTIC NEUTRON SCATTERING
H. Bjerrum Moeller and M. Nielsen *In* IAEA Instrumentation for Neutron Inelastic Scattering Res. 1970 p 49–76 refs (See N71-28701 16-14)
Avail: NTIS

The experimental resolution of neutron spectrometers for inelastic neutron scattering is considered. Various methods have been used to obtain the instrumental width of a measured neutron group: (1) calculation of an analytical expression for the resolution function and the use of this for computation of the instrumental width of a neutron group; (2) calculation of the individual contributions to the instrumental width, resulting from finite collimations, mosaic spread, finite pulse time etc., the sum of these contributions giving the total instrumental width of a measured neutron group; (3) the use of graphical methods for studying focusing effects; (4) measurement of the resolution function for elastic settings of the spectrometer and (5) calculation of the resolution by a Monte Carlo simulation. A review and a comparison of these different methods for triple axis spectrometers and time-of-flight spectrometers are presented. Author

N71-28706# Academia R. P. R., Bucharest. Inst. de Fizica Atomica.
EFFICIENCY OF NEUTRON CRYSTAL SPECTROMETERS IN THE WAVELENGTH RANGE 4 TO 10 A
D. Bally *In* IAEA Instrumentation for Neutron Inelastic Scattering Res. 1970 p 77–90 refs (See N71-28701 16-14)
Avail: NTIS

An analysis of the optical parameters which determine the resolution and the luminosity of a crystal monochromator is given. The relative reflectivity is calculated for two crystal arrangements: the symmetrical reflection arrangement and the symmetrical transmission arrangement. For these two arrangements the most favorable values of the ratio between the mosaic spread and collimator divergences and of the monochromator efficiency are also calculated. The optical parameters of a double crystal monochromator are analyzed. A criterion to estimate the efficiency of such a monochromator is obtained. An experimental set-up for very cold neutron scattering experiments is analyzed using a high flux pulsed reactor. Luminosities for the same resolution of different right optical tube systems, in connection with a beryllium filter and/or a chopper phased with the reactor, have been compared. It is shown that for a mean thermal neutron flux a simple and flexible experimental set-up can be used up to 10 A. It is also shown that in this device it is convenient to use a double crystal monochromator up to 6 A. From 6 A to 15 A, a beryllium filter must be used. Author

N71-28707# Institutt for Atomenergi, Kjeller (Norway).
ORIENTED GRAPHITE AS A NEUTRON MONOCHROMATOR
T. Riste *In* IAEA Instrumentation for Neutron Inelastic Scattering Res. 1970 p 91–104 refs (See N71-28701 16-14)
Avail: NTIS

A number of samples of oriented graphite of various thicknesses and of mosaic widths in the range 0.8–3.0 deg have been investigated for reflectivity of thermal neutrons. The observed values agree rather well with those calculated on the assumption of ideally imperfect samples. The peak reflectivity and the integrated reflectivity were found to be superior to other monochromators tested by a factor of about 2–10. For 4 A neutrons peak reflectivities above 0.9 are easily attained. An important feature is the absence of double Bragg scattering in graphite, leading to a considerable reduction of the intensity of extraneous neutrons in the primary beam. This was demonstrated by comparing the neutron spectra reflected from graphite and zinc monochromators. The merit of graphite monochromators in different set-ups for inelastic scattering experiments is discussed. Author

N71-28708# McMaster Univ., Hamilton (Ontario). Dept. of Physics.
THE REFLECTIVITY OF NEUTRONS BY DISTORTED COPPER CRYSTALS
R. R. Dymond and B. N. Brockhouse *In* IAEA Instrumentation for Neutron Inelastic Scattering Res. 1970 p 105–115 refs Supported by NRC of Can. (See N71-28701 16-14)
Avail: NTIS

The absolute reflectivities of the (200) planes of two mechanically distorted copper crystal slabs have been measured in reflection and transmission over a wavelength range from 0.8 to 2.0 A. The crystals, which had rocking curves with FWHM of about 30 minutes of arc, had integrated reflectivities ranging from about 6 minutes to 17 minutes, and peak reflectivities ranging from 20% to 55% for the different wavelengths. In view of the high angles of take-off these results compare favorably with those for any known type of neutron monochromator. The results are compared with calculations based on a model of an infinite mosaic slab, using effective linear absorption coefficients to account for the effect of simultaneous reflection. Author

N71-28709# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Festkoerrer- und Neutronenphysik.
ON THE THEORY AND OPTIMIZATION OF CORRELATION TIME-OF-FLIGHT EXPERIMENTS
F. Hossfeld, R. Amadori, and R. Scherm (Inst. Max von Laue/Paul Langevin, Grenoble, France) *In* IAEA Instrumentation for Neutron Inelastic Scattering Res. 1970 p 117–145 refs (See N71-28701 16-14)
Avail: NTIS

The principles of the correlation method are presented on the basis of a generalized theory taking account of (pseudo) statistical sequences of arbitrary duty cycle. By comparison of the conventional time-of-flight experiment with the correlation method a gain factor is obtained depending on the structure of the time-of-flight spectrum, on the background level, and on the period and the duty cycle of the chopper sequence. Thus, correlation experiments are optimized by selecting adequate sequences with an optimum duty cycle. A survey of all classes of binary pseudo-statistical sequences is given and the application of Markov chains as periodic sequences in connection with on-line correlation is discussed and some preliminary remarks are made on uncorrelated pseudo-statistical sequences with respect to the design of a statistical double chopper. Computer simulations of time-of-flight experiments demonstrate the power and limitations of the correlation method. The input transducer error involved in real pulse shapes and its influence on the correlation experiment are analyzed. Author

N71-28710# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Angewandte Kernphysik und Datenverarbeitungszentrale.
INVESTIGATIONS ON THE CORRELATION METHOD IN TIME-OF-FLIGHT EXPERIMENTS
W. Reichardt, F. Gompf, K. H. Beckurts, W. Glaeser, G. Ehret et al *In* IAEA Instrumentation for Neutron Inelastic Scattering Res. 1970 p 147–172 refs (See N71-28701 16-14)
Avail: NTIS

The problem of choosing an optimal chopping mechanism is tackled by minimizing a suitably defined statistical error of the time-of-flight distribution. This condition leads to a whole class of choppers which have different time utilization of the reactor beam. An extensive error analysis for these choppers is given. It is shown that the Gaussian law of error propagation is not strictly valid when the spectrum is obtained by a correlation method. Some considerations are given to the feasibility of a pseudo-statistical double chopper for slow neutrons, which allows the use of all energies in the incident beam and the measurement of all scattered energies simultaneously. The statistical accuracy for such an experiment is discussed. Author

N71-28711# Oak Ridge National Lab., Tenn. Solid State Div.
A MAGNETICALLY-PULSED TIME-OF-FLIGHT SPECTROMETER FOR INELASTIC NEUTRON SCATTERING
H. A. Mook and M. K. Wilkinson *In* IAEA Instrumentation for Neutron Inelastic Scattering Res. 1970 p 173–180 refs (See N71-28701 16-14)
Avail: NTIS

A very versatile time-of-flight spectrometer, which utilizes a magnetically pulsed neutron beam, has been developed for inelastic neutron scattering investigations of liquids and solids. The beam is pulsed by changing the direction of the atomic magnetic moments in a ferrite crystal with an applied magnetic field. Good reflectivity is obtained with these ferrite crystals, and since the magnetic anisotropy is small, the magnetic spin system can be changed rapidly by small external magnetic fields. The single crystal thus serves both as monochromator and pulser, and any type of pulse shape or length can be readily obtained because the pulsing is accomplished electronically. The pulse repetition rate can also be varied continuously so that the magnetic pulser can operate in any type of auto-correlation mode. Author

N71-28712# Institute of Nuclear Research, Vienna (Austria).
DEVELOPMENT AND IMPROVEMENTS OF SPIN-FLIP-CHOPPER SPECTROMETERS
H Rauch *In* IAEA Instrumentation for Neutron Inelastic Scattering Res. 1970 p 181–196 refs (See N71-28701 16-14)
Avail: NTIS

A spin flip chopper produces behind the resonance spin flip coil of a polarized neutron spectrometer a monochromatic neutron beam with a spin direction periodically up or down. Behind the analyzer there is a chopped neutron beam. The repetition rate of the neutron bursts and the duty cycle is chosen electronically to fulfill the experimental requirements better than the mechanical choppers. The spin flip chopper is especially favorable for investigating inelastic magnetic scattering, where the sample acts as analyzer too, and for the quasi-elastic part of the spectrum. The chopping action of the resonance coil is done either by periodically switching on and off the high frequency field, which lies in the direction of the neutron beam or by periodically switching on and off a suitable precision field perpendicular to the beam. The usual time-of-flight analysis is not necessary for the new double spin flip chopper device consisting of two spin flip choppers running at a distinct flight path and with an adjustable phase difference. Author

N71-28715# Institut Max von Laue/Paul Langevin, Grenoble (France).
UTILIZATION OF NEUTRON GUIDE TUBES FOR NEUTRON INELASTIC SCATTERING
B. Jacrot *In* IAEA Instrumentation for Neutron Inelastic Scattering Res. 1970 p 225–247 refs (See N71-28701 16-14)
Avail: NTIS

Neutron guide tubes play an important role in the instrumentation around nuclear reactors. The following items are reviewed (1) general principles of conducting tubes; (2) technical problems in the building of conducting tubes; (3) descriptions of existing installations and their performances; (4) specific interest of these tubes for inelastic scattering experiments; and (5) conducting tubes for high flux reactor. Author

N71-28731# TRW Systems Group, Redondo Beach, Calif.
THE DEVELOPMENT OF A WISP INFORMATION SYSTEM Final Report
Keith P. Jenkin and Richard C. Ramsey 25 Feb. 1971 149 p (Contract N62306-70-C-0274)
(AD-721385) Avail: NTIS CSCL 9/2

A data handling system was developed for WISP data. The procedure for the reduction of the raw flight data to graphic displays were refined in the program. Computed-generated maps are presented which enhance the various scene features and these are based upon the selection of the appropriate algorithms to fit the scene information. Polarization measurements of the airlight directed upward over the oceans were obtained up to 10,000 feet altitudes. The high values of polarization obtained suggest a significant gain in signal contrast will result from use of polarizers in spacecraft ocean color sensors. Low altitude spectrometer flights over sewage outfalls and red tide resulted in good correlation between the visible spectral nature of the upwelling light and ground truth turbidity and organism counts. Useful algorithms were developed to best characterize the nature of the spectral data and the existing types of water pollution. Spectrometer measurements of a deliberate oil spillage on the ocean indicated no visible signatures were present. Author (GRA)

N71-28858 National Lending Library for Science and Technology, Boston Spa (England).
AN INSTRUMENT FOR MEASURING LOAD SPECTRA [EIN GERAET ZUR MESSUNG VON LASTKOLLEKTIVEN]
K. Overlach 9 Apr. 1970 5 p ref Transl. into ENGLISH from Foerdern u Heben (Wiesbaden), v. 19, no. 7 p 398–399
(NLL-Lib-Comm-1525-(5196)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The development of a load spectrum counter is discussed. A load spectrum is generally understood to cover all the external forces acting on a mechanical part within a certain operating period, arranged by frequency and magnitude. The counter is designed to keep a check on the stresses on steel structures and conveyor systems at vital points. If such instruments are used, it is permissible to use lightweight structures with greater loads, provided that a specified number of higher loads is not exceeded. Author

N71-28863* National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
ION MICROPROBE MASS SPECTROMETER FOR ANALYZING FLUID MATERIALS Patent
Alfred E. Barrington, inventor (to NASA) Issued 2 Mar. 1971 4 p Filed 11 Apr. 1969 Cl. 250-49.5; Cl. 250-41.9; Int. Cl. H01j37/00; Int. Cl. G01n23/00
(NASA-Case-ERC-10014; US-Patent-3,567,927; US-Patent-Appl-SN-815367) Avail: US Patent Office CSCL 14B

An improved ion microprobe mass spectrometer type apparatus is described which is suitable for analyzing trace amounts of a fluid. The invention utilizes a target electrode for holding the sample, and a means for cooling the surfaces of the target to below a fixed temperature for a determined period of time. A stream of sample fluid is directed over the cooled surfaces of the target and is condensed thereon after which the target surface is sputtered by an

incident, high intensity primary beam directed obliquely onto the surface. Thereafter, means is provided for focusing the electrically charged ions of sample material that result in a secondary beam produced due to the bombardment of the sample layer. Additional means is provided to remove the prior material from the target surfaces after each analysis, so that the target surface is prepared for another sample layer. Official Gazette of the U.S. Patent Office

N71-28889*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
VIRTUAL IMAGE DISPLAY FOR FLIGHT SIMULATION
Bruce C. Ganzler Washington Jul. 1971 17 p refs
(NASA-TM-X-2327; A-3811) Avail: NTIS CSCL 14B

Simple uncorrected plastic lenses were used to provide a virtual image of a flight scene for use in a flight simulator. A virtual image display provides a realistic impression to the simulator pilot because the image seems to be a substantial distance from the simulator. A number of pilots made landings and takeoffs in a flight simulator to evaluate subjectively a virtual image display. The display consisted of a Schmidt color projector, rear projection screen and a large diameter, long focal length, plano-convex plastic lens. Another virtual image display utilizing a color television monitor and two plano-convex plastic lenses was evaluated without formal pilot comment. Various lens parameters were studied to determine their effect on the flight scene. The conclusion was that simple lenses could be used, with certain limitations, to obtain a usable virtual image of a flight scene with either a Schmidt projection system or a television monitor. Author

N71-28912 National Lending Library for Science and Technology, Boston Spa (England).
USE OF INFRARED SPECTROSCOPY IN STUDY OF AMPHIBOLE-ASBESTOS
O. B. Beisev et al Sep. 1970 9 p refs Transl. into ENGLISH from Geol. Raved. Mestorozhd. Tverd. Polez. Iskop. Kazakhstana (UCSR), 1968 p 319–323 In ENGLISH and RUSSIAN
(NLL-LTI-746-658-(9022.401); LTI-734-5818) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Infrared spectroscopy was applied in the analysis of different amphibole-asbestos. Particular attention was given to the appearance of analytical absorption strips for each form of the amphibole-asbestos. It was found that varieties of amphibole-asbestor can be identified, and free oxygen-hydrogen groups can be detected by infrared spectroscopy. F.O.S.

N71-28933* National Aeronautics and Space Administration. Langley Research Center, Langley Station.
SPECIALIZED HALOGEN GENERATOR FOR PURIFICATION OF WATER Patent
Robert A. Bruce Issued 6 Apr. 1971 6 p Filed 9 Oct. 1969 Cl. 204-263; Int. Cl. B01k3/10
(NASA-Case-XLA-08913; US-Patent-3,574,084;
US-Patent-Appl-SN-865109) Avail: US Patent Office CSCL 07D

An apparatus for treating water with a specialized halogen gas is described which includes a vessel having an electrolyte containing chamber, an anodic chamber, and a water treatment chamber. A means to remove the halogen from the electrolyte and permit it to be dissolved in water passing through the water treatment chamber is provided.
Official Gazette of the U.S. Patent Office

N71-28935* Milliken (D. B.) Co., Arcadia, Calif.
FILM FEED CAMERA HAVING A DETENT MEANS Patent
Donald B. Milliken, inventor (to NASA) Issued 17 Jan. 1967 5 p Filed 14 May 1963 Cl. 226-58 Sponsored by NASA
(NASA-Case-LAR-10686; US-Patent-3,298,582;
US-Patent-Appl-SN-280362) Avail: US Patent Office CSCL 14E

An apparatus is described for holding motion picture film securely in a camera gate under severe vibration and high acceleration loads. A gate for longitudinal film guidance and a detent means to hold the film in a fixed longitudinal position in the gate are provided which prevent the shuttle tip from puncturing the film. J.M.

N71-28958* California Computer Products, Inc., Anaheim.
TEMPERATURE REGULATION CIRCUIT Patent
Donald W. Gade and Franklyn L. Wiley, inventors (to NASA) Issued 27 Jul. 1965 8 p Filed 4 Mar. 1963 Cl. 219-413 Sponsored by NASA
(NASA-Case-XNP-02792; US-Patent-3,197,616;
US-Patent-Appl-SN-262596) Avail: US Patent Office CSCL 14B

A thermal differential circuit is provided to stabilize and properly regulate the control circuitry of a precision oven device containing electronic components. The circuit provides increased control accuracy by measuring the temperature differential between the interior and exterior of the enclosure. E.H.W.

N71-28991* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ANALOG TO DIGITAL CONVERTER TESTER Patent
Charles H. Russell, inventor (to NASA) Issued 18 May 1971 6 p Filed 6 Oct. 1969 Cl. 324-73; Cl. 340-347AD; Cl. 324-5; Int. Cl. G01r15/12
(NASA-Case-XLA-06713; US-Patent-3,578,103;
US-Patent-Appl-SN-863913) Avail: US Patent Office CSCL 14B

An apparatus is described for automatically testing an analog to digital converter (ADC) for open and short circuits. A tester is connected to the contacts on the ADC shaft. The ADC motor turns the ADC shaft to a specific setting and in response to this setting means are provided for stopping the motor and producing a signal having a predetermined duration which is applied to the tester. The tester, in response to this signal, performs the open and short circuit tests for the specific setting of the ADC shaft. If there are no open or short circuits, the tester produces another signal which causes the ADC motor to turn the ADC shaft to another specific setting for testing. If there is an open or short circuit, the tester does not produce said another signal and a buzzer sounds. The operator can then look at lights on the tester to determine where the open or short circuit is located.
Official Gazette of the U.S. Patent Office

N71-28992* National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
ORIFICE GROSS LEAK TESTER Patent
Thomas L. Altshuler, inventor (to NASA) Issued 18 May 1971 6 p Filed 7 May 1969 Cl. 73-40.7; Cl. 250-41.9(S); Int. Cl. G01m3/16
(NASA-Case-ERC-10150; US-Patent-3,578,758;
US-Patent-Appl-SN-822519) Avail: US Patent Office CSCL 14B

An orifice leak tester for use with a helium mass spectrometer is disclosed. The leak tester comprises a sample chamber, wherein an article to be tested is supported on a wire screen; an orifice formed in a wall common to the sample chamber and mass spectrometer specimen chamber; and means for directing a purging gas over the orifice and through the sample chamber. A specimen pressurized with helium gas is introduced into the previously purged sample chamber. Helium gas effusing from a leaking specimen flows through the pressure limiting orifice and is detected by the spectrometer.
Official Gazette of the U.S. Patent Office

N71-28993* Spaco, Inc., Huntsville, Ala.
METHOD AND DEVICE FOR DETECTING VOIDS IN LOW DENSITY MATERIAL Patent
Edward K. Vukelich and William D. Howard, inventors (to NASA) Issued 13 Apr. 1971 4 p Filed 2 Jul. 1969 Cl. 356-209; Cl. 250-219; Int. Cl. G01n21/48 Sponsored by NASA

(NASA-Case-MFS-20044; US-Patent-3,574,470; US-Patent-Appl-SN-838630) Avail: US Patent Office CSCL 14B

A method and device are described for detecting abnormal voids in a low-density material such as polyurethane foam insulation. Light is beamed into the material and the light reflected from the material is received by a photodetector which converts the light into a voltage level proportional to the light intensity received by the detector. The intensity of the reflected light decreases when the light is beamed into low-density material having an abnormal void and the void is indicated by resultant reduction in voltage output of the photodetector.

Official Gazette of the U.S. Patent Office

N71-28984* National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.

DEVICE FOR MEASURING LIGHT SCATTERING WHEREIN THE MEASURING BEAM IS SUCCESSIVELY REFLECTED BETWEEN A PAIR OF PARALLEL REFLECTORS Patent

Alfred E. Barrington, inventor (to NASA) Issued 18 May 1971 4 p Filed 11 Apr. 1969 Cl. 815366

(NASA-Case-XER-11203; US-Patent-3,578,867; US-Patent-Appl-SN-815366) Avail: US Patent Office CSCL 14B

A method and device are disclosed for determining the gas density within a vacuum chamber by measuring the scattered radiation produced when a gas passes through an apparent single coherent beam of light. The beam is directed onto the first of a pair of highly reflective, parallel surfaces and caused to be successively reflected therebetween, the reflecting surfaces being located within the vacuum chamber. Official Gazette of the U.S. Patent Office

N71-29041* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

MAKSUTOV SPECTROGRAPH Patent

Gale A. Harvey, inventor (to NASA) Issued 13 Apr. 1971 5 p Filed 26 Sep. 1968 Cl. 356-76; Int. Cl. G01j3/40

(NASA-Case-XLA-10402; US-Patent-3,574,462; US-Patent-Appl-SN-762935) Avail: US Patent Office CSCL 14B

A spectrograph especially suited for research analysis of low level sources in such areas as reentry spectroscopy, is described. The spectrograph comprises a high efficiency transmission grating or prism combined with a simplified Maksutov optical layout, and features lightweight structural components and arrangements. These arrangements minimize thermally induced misalignments and simple adjustment mechanisms for focus of the film surface and alignment of the optical elements.

Official Gazette of the U.S. Patent Office

N71-29134* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

RESPONSE ANALYZERS FOR SENSORS Patent

Bobby G. Bynum and Drayton H. Talley, inventors (to NASA) Issued 18 May 1971 5 p Filed 30 Jul. 1969 Cl. 73-1R; Cl. 73-304C; Int. Cl. G01f25/00

(NASA-Case-MFS-11204; US-Patent-3,578,755; US-Patent-Appl-SN-845991) Avail: US Patent Office CSCL 14B

An apparatus for measuring the performance of liquid level sensors under dynamic conditions is reported. The apperatus includes a motor driven cam having a cam groove formed therein. A cam follower riding in the cam groove drives a pivotally mounted lift rod which in turn drives a slide rod to which a sensor being tested is attached. The slide rod is positioned with respect to a container such that the attached sensor is moved in and out of a liquid in the container. A first signal generating means is provided that indicates when the sensor actually first enters the liquid and another signal is generated by the sensor when it senses entering the liquid. By monitoring the time lapse between the signals it is possible to determine the response characteristics of the sensor upon entry into a liquid. A camera and light source are utilized to photograph conditions within the container during test of a sensor. Official Gazette of the U.S. Patent Office

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N71-28011*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

LIQUID ROCKET ENGINE TURBOPUMP BEARINGS: SPACE VEHICLE DESIGN CRITERIA (CHEMICAL PROPULSION)

Russell B. Keller, Jr., ed. and Myles F. Butner (Rocketdyne) Mar. 1971 85 p refs

(NASA-SP-8048) Avail: NTIS CSCL 13I

The operating conditions of speed, life and environment for liquid rocket engine turbopump bearing are investigated. Attempts are made to develop longer life bearings, roller bearings cooled by propellants, higher speed bearings, and bearings for service with liquid fluorine. Attempts are also made to solve the problems of ball speed variation. In addition, bearing material development programs for space environments, applications with heat soakback, hot restarts, and extended exposures to propellants at elevated temperature, are discussed. Computer calculations are utilized to evaluate the effects of speed, geometry, and loading on bearing life, stresses, and deflections, and to determine bearing spring rates used for shaft dynamics calculations. E.H.W.

N71-28018*# Midwest Research Inst., Kansas City, Mo.

FASTENER LOAD ANALYSIS METHOD Final Report, 28 Jan. 1970 - Apr. 1971

Fred R. Rollins, Jr. 2 Apr. 1971 66 p refs

(Contract NAS8-25362)

(NASA-CR-61354; DCN-1-0-60-00081(1F)) Avail: NTIS CSCL 13E

The feasibility of analyzing bolt preloads by ultrasonic techniques was investigated, and a pulse echo interferometric method was selected. The interferometer response was found to be linearly related to tensile stresses oriented parallel to the bolt axis. Under rather idealized conditions, bolt loads can be determined with errors of less than 1%. The ultimate operational accuracy depends on variables such as bolt dimensions and geometry, volt temperature, uniformity of stresses, and bolt materials, but load analyses to within + or - 3% are readily achievable. Best results are obtained with the ultrasonic transducer contact coupled to a small flat area near the center of the bolt head. The transducer can be applied and measurements made without interfering with normal wrenching operations. Prototype instrumentation is described and calibration results are tabulated for numerous bolt sizes and materials. The possibility of using this instrumentation for rechecking bolt loads subsequent to assembly is also discussed. Author

N71-28037*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EFFECT OF SURFACE FILMS ON DEFORMATION OF ZINC SINGLE-CRYSTAL SURFACE DURING SLIDING

Donald H. Buckley Washington Jun. 1971 16 p refs

(NASA-TN-D-6366; E-6200) Avail: NTIS CSCL 20L

Sliding friction experiments were conducted on zinc single crystal (0001) surfaces with sliding restricted to the (1010) directions. A ruby ball (9.0-mm diam) contacted the crystal surface under loads of from 50 to 300 g at sliding velocities from 0.02 to 14 mm/min. Surface films influenced plastic deformation. Oxides reduced plastic deformation, while organic films increased plasticity during sliding. Ion implanted lead films also increased plasticity. Deformation mode was also influenced by the film present. With an oxide film, twins were observed, while with organic films, deformation was exclusively by slip. The higher the sliding velocity, the less the surface deformation. Track width increased with transition from the brittle to ductile state. Author

N71-28038*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EFFECT OF CONTACT ANGLE ON ROLLING-ELEMENT FATIGUE LIFE WITH A FLUORINATED ETHER LUBRICANT AT A CRYOGENIC TEMPERATURE OF 170 K (305 DEG R)

Marshall W. Dietrich, Dennis P. Townsend, and Erwin V. Zaretsky Washington Jun. 1971 21 p refs

(NASA-TN-D-6367; E-6045) Avail: NTIS CSCL 11H

Rolling element fatigue tests were conducted at a temperature of 170 K (305 deg R) at contact angles of 20, 30, and 40 deg in a modified five ball fatigue tester with AISI 52100 steel balls. A fluorinated ether fluid was used as the lubricant. The maximum Hertz stress was 5500 MN/sq m (800,000 psi). Test results indicate that there is a decrease in fatigue life with increased contact angle. The differences in fatigue life were not statistically significant. The decrease in life with contact angle in fluorinated ether fluid at 170 K (305 deg R) is identical to the trend with a diester fluid at 328 K (590 deg R). Analysis indicates that this decrease in fatigue life is caused by decreased EHD film thickness and decreased ball hardness due to increased contact temperature. The increase in contact temperature was of the same order of magnitude for the tests with a fluorinated ether at 170 K (305 deg R) as with a diester at 328 K (590 deg R). Author

N71-28045*# Battelle Memorial Inst., Columbus, Ohio.

DEVELOPMENT OF EXPLOSIVE WELDING TECHNIQUES FOR FABRICATION OF REGENERATIVELY COOLED THRUST CHAMBERS FOR LARGE ROCKET ENGINE REQUIREMENTS Final Report, 28 Jun. 1967 - 15 Sep. 1970

E. G. Smith, Jr., D. Laber, V. D. Linse, and M. J. Ryan 15 Jun. 1971 114 p refs

(Contract NAS3-10306)

(NASA-CR-72878) Avail: NTIS CSCL 13H

Explosive welding was investigated as a new technique for fabricating regeneratively cooled rocket motor thrust chambers. The process developed consisted of the explosive welding of the ribs to the outer shell and the inner liner to the ribs to form the desired coolant channels in flat panel specimens, cylindrical spoolpieces, and complex-shaped thrust chamber segments. Techniques for evaluating the explosive welded channel structures included metallography, ultrasonic inspection, hydrostatic proof testing and burst testing. Author

N71-28046*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

OPTIMIZATION OF CONICAL HYDROSTATIC BEARING FOR MINIMUM FRICTION

Lester J. Nypan, Bernard J. Hamrock, Herbert W. Scibbe, and William J. Anderson Washington Jun. 1971 37 p refs

(NASA-TN-D-6371; E-6101) Avail: NTIS CSCL 13I

Equations for the flow rate, load capacity, and friction torque for a conical hydrostatic bearing were developed. These equations were solved by a digital computer program to determine bearing configurations for minimum friction torque. Design curves are presented. Results are shown for both laminar and turbulent flow conditions. Author

N71-28159*# Techtran Corp., Glen Burnie, Md.

REFORMING OF GASEOUS HYDROCARBONS INTO TOWN GAS [OMZETTING VAN KOOLWATERSTOFFEN IN STADSGAS]

Joap Van Willigen (Ph.D. Thesis Technisch Hogeschool, Delft (Netherlands) Washington NASA Jun. 1971 140 p refs Transl. into ENGLISH from Dutch report

(Contract NASw-2037)

(NASA-TT-F-13668) Avail: NTIS CSCL 13H

The reforming reaction of hydrocarbons with steam is a homogeneous gas phase reaction with an induction period that needs only a thin layer of catalyst to start the reaction. Accordingly, a mixture of hydrocarbons and steam heated to at least 600 C is passed through a thin layer of catalyst, during which passage the reforming starts whereupon the reaction is completed in the empty reactor chamber above the catalyst. The need for heat for the endothermic reaction may be met by external heating, but also by adding air or oxygen to the gas mixture. Author

N71-28185# Picatinny Arsenal, Dover, N.J.

FAILURE OF ADHESIVE BONDS AT CONSTANT STRAIN RATES

Elise McAbee, Michael J. Bodnar, William C. Tanner, and David W. Levi Mar. 1971 35 p refs

(AD-722238; PA-TR-4152) Avail: NTIS CSCL 13/5

Shear strengths of adhesive AF126 bonds to two thicknesses of aluminum were measured at constant rate of crosshead separation. Primarily cohesive failure was observed in all cases. By using relations proposed by Cherry and Holmes, the shear strength could be quantitatively related to temperature and strain rate or failure time. Of specific engineering interest would be the possibility of determining the reliability of a bonded joint for specific periods of time as a function of continuously applied stress at a given temperature. Author (GRA)

N71-28231*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

FRICTION AND WEAR OF SINTERED TUNGSTEN, MOLYBDENUM, AND COBALT-MOLYBDENUM IMPREGNATED WITH A FLUORIDE EUTECTIC

Harold E. Sliney and Robert L. Fusaro Washington Jun. 1971 23 p refs

(NASA-TN-D-6363; E-6165) Avail: NTIS CSCL 11F

A friction and wear study was conducted in an argon atmosphere on self-lubricating composites made of porous metals (44 percent dense) and 38 wt%CaF2-62 wt%BaF2 eutectic. The metals used were tungsten, molybdenum, and an alloy of 75 wt% cobalt-25 wt% molybdenum. Each proved to be a suitable matrix material for the fluoride lubricant. The best results were obtained with the filled Co-25Mo composite. The metal alloy and fluoride filler in this composite seemed to be of mutual benefit in providing a lower friction coefficient over a wider range of temperature. At a sliding velocity of 2.6 meters per second the friction coefficient was 0.35 at ambient temperatures and dropped off linearly to 0.10 at 900 C. Wear was not markedly affected by temperature, and the wear rate was three orders of magnitude lower than was obtained in control tests with denser, unlubricated tungsten, molybdenum, and Co-25Mo. Author

N71-28282*# National Aeronautics and Space Administration, Washington, D.C.

VALVE TECHNOLOGY: A COMPILATION

1970 20 p

(NASA-SP-5927(01)) Avail: NTIS CSCL 13K

Advances in valve technology are outlined which have potential use in the petrochemical, food processing, pharmaceutical, plastics, electronics, and automotive industries. Relief valves, cryogenic check valves, valves for extreme conditions, safety valves, and leadproof designs are discussed. Volumetric measuring devices, indirect valve timing a dynamically stable check valve for wide flow ranges, and a low power input fluid control circuit are also mentioned. J.M.

N71-28398# Mechanical Technology, Inc., Latham, N.Y. Research and Development Div.

A STATUS REVIEW OF EXTERNALLY PRESSURIZED, STEAM LUBRICATED BEARINGS

Coda H. T. Pan, Eli B. Arwas, Eugene Finkin and Stanley B. Malanoski Feb. 1971 83 p refs

(Contract N00014-71-C-0074)
(AD-722005; MTI-71TR6) Avail: NTIS CSCL 13/9

Lubrication with condensible vapors, such as steam near its saturation condition introduces new problems of bearing design, notably the prevention of steam-hammer instability and of film collapse induced by condensation. These problems are discussed in this report. The problem of materials selection for steam-lubricated bearings is reviewed with regard to the properties desired of candidate materials, and the results of erosion tests with solid materials and plasma-sprayed coatings are discussed. Experiments conducted to establish load capacity, stiffness flow and instability thresholds of steam-lubricated journal and thrust bearings are described and the results compared with theoretical prediction. A 500-hour endurance test recently completed with a 200-pound rotor fully supported in steam lubricated bearings is described with emphasis on the practical requirements of steam lubricated bearings.
Author (GRA)

N71-28402*# National Aeronautics and Space Administration, Washington, D.C.
MEASUREMENT TECHNOLOGY: A COMPILATION
1970 23 p
(NASA-SP-5926(01)) Avail: NTIS CSCL 13H

A compilation of measurement methods and devices for general industrial application is given. Data are given for pressure, temperature, linear, angular, and surface measurements. Criteria for surface, linear and angular measurements are flatness, concentricity, area, contour, depth, length, width, and height. The characteristics of fluids in the area of leakage and flow rates, and the systems used to determine such activities are also given.
E.H.W.

N71-28432# Massachusetts Inst. of Tech., Cambridge.
IN-PROCESS MANUFACTURING QUALITY CONTROL
Donal E. Lewin (Ph.D. Thesis) Jan. 1971 539 p refs
(Contract N00014-70-A-0362-0001)
(AD-720098; MAC-TR-83) Avail: NTIS CSCL 13/8

The thesis develops a methodology for designing plans for the allocation of in-process inspection effort. The focus of the thesis is on constructing operating rules for the allocation of inspection effort along a production line in which inspection and repair are integral parts of that line. The essential feature of such operating rules is their adaptability, i.e., their capacity to detect and respond to changes in the quality levels at various parts of the manufacturing process. The basic methodology is an application of micro-economic analysis to the production process. The major features restricting the problem setting needed for the proposed methodology to be applicalbe are the following: (1) discrete production units and production sub-processes; (2) identifiability of a finite set of independent attribute defects (or surrogate defects); (3) no information available to monitor the current state of the production process by any means other than inspection of the product; (4) nondestructive inspection, and (5) repairable defects.
Author (GRA)

N71-28465* National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
FLUID POWER TRANSMITTING GAS BEARING Patent
Philip M. Yang, Dennis F. Collins, Jr., Frederick D. Ezekiel, and Robert R. de Furia, inventors (to NASA) Issued 8 Jun. 1971 5 p Filed 6 Feb. 1969 Cl. 308-170; Int. Cl. F16c1/24
(NASA-Case-ERC-10097; US-Patent-3,583,777; US-Patent-Appl-SN-797059) Avail: US Patent Office CSCL 13I

A simple, almost frictionless bearing is described, including an upper bearing plate with a central bore and bleed holes, and a base assembly with a standpipe extending vertically into the central bore of the upper plate. The base assembly comprises a volume plate and a lower bearing plate, both having radially spaced passages connected by a common chamber for providing a thin film of fluid between the upper and lower bearing plates. These plates also have a central bore that communicated with the standpipe. In operation, a common fluid power supply pressurizes the passages and the central bore of the standpipe of the base assembly so that a high pressure condition is present at the perimeter of the base assembly while bleed holes in the upper bearing plate create a low-pressure condition at the center of the bearing.
Official Gazette of the U.S. Patent Office

N71-28467* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
FRICTIONLESS UNIVERSALJOINT Patent
Sherwood D. Mayall, inventor (to NASA) Issued 13 Apr. 1971 6 p Filed 4 Apr. 1969 Cl. 64-18; Int. Cl. F16d3/42 Sponsored by NASA
(NASA-Case-NPO-10646; US-Patent-3,574,277; US-Patent-Appl-SN-813488) Avail: US Patent Office CSCL 13E

The invention describes a universal joint having two coupling members pivotally connected to a gimbal plate about two axes of rotation. The pivot members that interconnect the relatively rotating members each include a pair of sleeves flexibly connected to each other by a plurality of leaf springs. The relative flexing of each pair of sleeves permits each pivot member to be fixedly mounted within bores formed within the respective coupling members and gimbal plate, thereby enabling the universal joint to operate frictionlessly without lubrication.
Official Gazette of the U.S. Patent Office

N71-28500# National Bureau of Standards, Washington, D.C.
REPORT OF THE 55th NATIONAL CONFERENCE ON WEIGHTS AND MEASURES 1970
Francis C. Bell and Harold F. Wollin, eds. Apr. 1971 317 p refs Conf. held Salt Lake City, 13 - 17 Jul. 1970; sponsored by NBS
(NBS-Spec-Publ-342) Avail: SOD $1.75

The proceedings (edited) of the Fifty-fifth National Conference on Weights and Measures, sponsored by the National Bureau of Standards, held in Salt Lake City, Utah, July 13 - 17, 1970 are reported. The conference was attended by state, county, and city weights and measures officials and representatives of the Federal Government, business, industry, railroads, and associations.
Author

N71-28562*# Radio Corp. of America, New York.
HERMETICALLY SEALED SEMICONDUCTOR PACKAGE Patent Application
David S. Jacobson, inventor (to NASA) 11 p Filed 27 Oct. 1970
(Contract NAS5-10066)
(NASA-Case-GSC-10791-1; US-Patent-Appl-SN-84289) Avail: NTIS CSCL 11A

A hermetically sealed coaxial package suitable for housing microwave semiconductor components is described. The package comprises a collector stud having a flange intermediate to the ends of the stud. One end of the stud is generally conically formed and has a flat top or plateau upon which the semiconductor component is mounted. An insulating ring is mounted on one surface of the flange around the conical end of the stud. An electrically conductive washer is mounted on the other side of the insulating ring so that it is adjacent the flat top of the conical end of the collector stud. Located above the metallic washer is an insulating washer and located above the insulating washer is a metallic cap. The stud, the electrically conductive washer, and the cap form the external connections to the semiconductor component.
NSA

N71-28568# National Bureau of Standards, Washington, D.C. Office of Weights and Measures.
WEIGHTS AND MEASURES LABELING HANDBOOK Final Report
David E. Edgerly May 1971 395 p refs
(NBS-HB-108) Avail: SOD $3.25

The Weights and Measures Labeling Handbook has been

prepared for use by state weights and measures officials in the enforcement of state laws and regulations pertaining to the packaging and labeling of commodities. The handbook provides a cross indexed compilation of the requirements of the Model State Packaging and Labeling Regulation, U. S. Department of Agriculture regulations, and regulations of the Food and Drug Administration and Federal Trade Commission issued pursuant to the Fair Packaging and Labeling Act. Author

N71-28582* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

PROCESS FOR GLASS COATING AN ION ACCELERATOR GRID Patent

Bruce A. Banks, inventor (to NASA) Issued 6 Apr. 1971 3 p Filed 19 Sep. 1968 Cl. 117–224; Int. Cl. C23d5/04, 7/00

(NASA-Case-LEW-10278-1; US-Patent-3,573,977; US-Patent-Appl-SN-760928) Avail: US Patent Office CSCL 11B

A minimizing process is reported for bubbles in a fused glass coating on a perforated plate forming the single grid of an ion thrustor accelerator system. A slurry coated grid is first heated in a helium atmosphere which is subsequently changed to argon so that entrapped helium diffuses out of the glass. Official Gazette of the U.S. Patent Office

N71-28611 Illinois Univ., Urbana.

STUDY OF INSTANTANEOUS LOAD TO WHICH GEAR TEETH ARE SUBJECTED

William Frank Hahn (Ph.D. Thesis) 1969 143 p Avail: Univ. Microfilms Order No. 70-13336

Two models were developed for simulating a gear train system to determine the instantaneous load to which gear teeth are subjected. Both the fixed stiffness and the variable stiffness models include deformable elements and masses in a gear train as well as the gears themselves and allow the gear train to be subjected to various types of loading. The models also allow the gears to operate with backlash, allow for errors in gear geometry, and account for multiple tooth engagement. The fixed stiffness model treats multiple tooth engagement and tooth flexibility as well as the gear tooth geometry as a fixed rectangular stiffness function based on theoretical contact ratio and average tooth stiffness. The variable stiffness model deals with exact gear tooth profiles. Tooth flexibility is considered as a function of contact position. Multiple tooth engagement, premature and postmature contact, and contact position are determined by examination of gearing geometry changes under operating conditions. Dissert. Abstr.

N71-28648# California Univ., Livermore. Lawrence Radiation Lab.

RESPONSE OF A RIGID BODY WITH SIX DEGREES OF FREEDOM ON NONLINEAR SUPPORTS SUBJECTED TO GROUND SHOCK FROM AN UNDERGROUND NUCLEAR DETONATION

H. Joseph Weaver, Jr. 17 Dec. 1970 17 p refs Sponsored by AEC

(UCRL-50973) Avail: NTIS

A new shock mounting configuration, called the Universal Guided Column (U. G. C.) system, being used to protect sensitive electronic equipment subjected to ground shock from an underground nuclear detonation, is described. An analytical study of the U. G. C. system is presented. Author (NSA)

N71-28678 California Univ., Berkeley.

EXPERIMENTAL INVESTIGATION OF FRICTIONAL BEHAVIOR BETWEEN METALLIC AND SILICATE SOLIDS IN ULTRAHIGH VACUUM

Eleazar Ifechukwukelu Ofodile (Ph.D. Thesis) 1969 177 p Avail: Univ. Microfilms Order No. 70-13130

A quantitative analysis of the factors influencing frictional behavior of basalt and aluminum surfaces was made. The proposed mathematical model incorporated parameters of surface roughness, surface cleanliness, and surface energy. Experiments, under varying conditions of cleanliness, were performed to determine the frictional characteristics between flat basalt specimens and spherical aluminum riders having a 10 in. diameter. The specimen surfaces were moved tangential to each other in air and ultrahigh vacuum. Vacuum tests, in the 10 to the minus 7th power Torr to 10 to the minus 8th power Torr range, involved surfaces which were chemically cleaned with acetone and degassed at high temperatures as well as surfaces which were ion-bombarded (sputtered) in order to remove oxide films from the surface. The coefficient of friction was found to be strongly influenced by the normal load, particularly at small loads. At all normal loads, the ion bombarded surfaces exhibited higher coefficients of friction than chemically clean surfaces in vacuum or in air. Dissert. Abstr.

N71-28679*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

AN IMPROVED SPIRAL GROOVE SEAL Patent Application

Lawrence P. Ludwig and Thomas N. Strom, inventors (to NASA) 11 p Filed 13 Jul. 1970

(NASA-Case-LEW-10326-2; US-Patent-Appl-SN-54540) Avail: NTIS CSCL 11A

A low leakage shaft seal which can be used with many types of liquids, such as water, sodium, and oils is described. A spiral groove geometry pattern is arranged so that movement of the seal seat causes the grooves to produce a pumping action against the sealed fluid pressure. This provides a means by which fluid can pump back as it leaks out. The pattern also provides a hydrodynamic lifting force which produces a positive separation of radial surfaces when the shaft rotates. Engagement of these surfaces prevents leakage when the shaft is stationary, and separation of these surfaces when the shaft is rotating reduces wear. E.H.W.

N71-28727 National Lending Library for Science and Technology, Boston Spa (England).

CONTEMPORARY IDEAS ON THE FRICTION MECHANISM IN A METAL/GRAPHITE PAIR

L. A. Plutalova 20 Jan. 1970 12 p refs Transl. into ENGLISH of Russian report

(NLL-Risley-Tran-1881-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The need for developing antifriction materials is discussed, with emphasis placed on the special properties of graphite. These are cited as (1) low coefficient of friction when in contact with metal, only slight wearing of the graphite material, and no wearing of the metal; (2) excellent heat resistance, thermal conductivity, and corrosion resistance; and (3) low density, and high compressive and binding strength. The self-lubricating nature of graphite is explained as its ability to split easily along the cleavage planes and to recombine as a whole; its orientation in the molecular field of the surface under normal pressure applied to this surface; and its capability to form a firmly adhering, thin dense film of oriented graphite layers on the metal surface as a result of unsaturated bonds which occur during cleavage. Summary data are included on experiments conducted to determine the friction force between graphite samples and various metals. M.G.J.

N71-28740* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

ANGULAR DISPLACEMENT INDICATING GAS BEARING SUPPORT SYSTEM Patent

Edgar D. Kersey, Jr., inventor (to NASA) Issued 8 Jun. 1971 4 p Filed 1 May 1969 Cl. 356-150; Cl. 73-147; Cl. 356-152; Cl. 356-153; Int. Cl. G01b11/26

(NASA-Case-XLA-09346; US-Patent-3,583,815; US-Patent-Appl-SN-820964) Avail: US Patent Office CSCL 13I

A support arrangement incorporating a gas bearing especially adapted for frictionless pivotal support of test models together with

a provision for measuring the angular displacement of the model in the support is described. This bearing features a zero power quartz lens forming the bottom of the gas chamber combined with a light beam angular displacement measuring system. The model cooperates with a reflector on the bearing ball to provide accurate indications of angular deflections of the ball and the attached model. Official Gazette of the U.S. Patent Office

N71-28854*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ROLLING-ELEMENT FATIGUE LIVES OF THROUGH HARDENED BEARING MATERIALS

Richard J. Parker and Erwin V. Zaretsky 1971 27 p refs Proposed for presentation at Joint Lubrication Conf., Pittsburgh, 5–7 Oct. 1971; Sponsored by ASME and the Am. Soc. of Lubrication Engr.

(NASA-TM-X-67874; E-5687) Avail: NTIS CSCL 13I

Rolling-element fatigue tests were run with eight through-hardened bearing materials at 150 F. One-half inch diameter balls of each material were run in five-ball fatigue testers. Care was taken to maintain constant all variables known to affect rolling-element fatigue life. The longest lives at 150 F were obtained with AISI 52100. Ten-percent lives of the other materials ranged from 7 to 78 percent of that obtained with 52100. A trend was indicated toward decreased rolling-element fatigue life with increased total weight percent of alloying elements. Three groups of 120 mm bore ball bearings made from AISI M-1, AISI M-50, and WB-49 were fatigue tested at an outer-race temperature of 600 F. The 10-percent lives of the M-50 and M-1 bearings exceeded the calculated AFBMA life by factors of 13 and 8, respectively. The bearings with WB-49 races showed lives less than AFBMA life. The results of the bearing tests at 600 F correlate well with the results of the five-ball fatigue data to 150 F. Author

N71-28887*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

OPTIMIZATION OF CONICAL HYDROSTATIC BEARING FOR MINIMUM FRICTION

Lester J. Nypan, Bernard J. Hamrock, Herbert W. Scibbe, and William J. Anderson 1971 21 p refs Proposed for presentation at Joint Lubrication Conf., Pittsburgh, 5–7 Oct. 1971; Sponsored by ASME and the Am. Soc. of Lubrication Engr.

(NASA-TM-X-52946; E-6101) Avail: NTIS CSCL 13I

Equations for the flow rate, load capacity, and friction torque for a conical hydrostatic bearing were developed. The equations were solved by a digital computer program to determine bearing configurations for minimum friction torque. Design curves are presented that show optimal bearing dimensions or minimum friction torque as a function of dimensionless flow rate for a range of dimensionless load capacity. Results are shown for both laminar and turbulent flow conditions. The results indicate that hydrostatic pocket friction is a significant portion of the total friction torque. However, the bearing dimensions for a minimum friction design are affected very little by inclusion of pocket friction in the analysis. For laminar flow the values of the outer-land radius ratio and outer bearing radius ration X sub 4 did not change significantly with increasing friction factor. For turbulent flow, the X sub 4 value did not change with increasing friction factor; therefore, the value determined for X sub 4 in the laminar flow case is valid for all turbulent flows. Author

N71-28907*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

THE SERIES HYBRID BEARING: A NEW HIGH SPEED BEARING CONCEPT

William J. Anderson, David P. Fleming, and Richard J. Parker 1971 28 p refs Proposed for presentation at Lubrication Conf. Pittsburgh, 5–7 Oct. 1971; Sponsored by the Am. Soc. of Lubrication Engr. and ASME

(NASA-TM-X-67873; E-5817) Avail: NTIS CSCL 13I

The series hybrid bearing which couples a fluid-film bearing with a rolling-element bearing such that the rolling-element bearing inner race runs at a fraction of shaft speed was studied. The bearing was analyzed and experiments were run at thrust loads from 100 to 300 pounds and speeds from 4000 to 30,000 rpm. Agreement between theoretical and experimental speed sharing was good. The lowest speed ratio (ratio of ball bearing inner-race speed to shaft speed) obtained was 0.67. This corresponds to an approximate reduction in DN value of 1/3. For a ball bearing in a 3 million DN application, fatigue life would theoretically be improved by a factor as great as 8. Author

N71-28911 Illinois Univ., Urbana.

THE INFLUENCE OF AXIAL VIBRATIONS UPON THE ENERGY LOSSES AND EFFICIENCY OF SPUR GEAR SYSTEMS

Michael Mounir Mamoun (Ph.D. Thesis) 1969 299 p

Avail: Univ. Microfilms Order No. 70-13406

The influence of an axial vibrational motion upon the frictional energy losses and the efficiency of a spur gear system is analytically and experimentally investigated and determined. A theory is developed that does not only explain the influence of axial vibrations upon the frictional forces arising from the sliding of the engaging gear teeth, but it also reveals the effects of a two-dimensional motion or axial vibrations on the frictional forces between any two contacting surfaces. Based upon this theory, some mathematical expressions are derived for the frictional energy losses and the efficiency of a spur gear system subjected to axial vibrations. Dissert. Abstr.

N71-28914*# Translation Consultants, Ltd., Arlington, Va.

ACOUSTICA EMISSION IN NONDESTRUCTIVE INSPECTION [EMISSAO ACUSTICA NA INSPECAO NAO DESTRUTIVA]

L. X. Nepomuceno et al Washington NASA Jun. 1971 10 p refs Transl. into ENGLISH from Brazilian report 700/E-013

(Contract NASw-2038)

(NASA-TT-F-13643; Rept-700/E-013) Avail: NTIS CSCL 14D

The development of procedures for using acoustical emissions for nondestructive testing is investigated. The phenomenon of acoustical emission is described and a theoretical model which explains the experimental data is given. The methods for detecting fractures and deformation in materials is described. Examples of the analysis of fractures and the determination of critical loads for structures is included. Author

N71-28934*# Boeing Co., Kent, Wash. Aerospace Group.

FEASIBILITY AND CONCEPTUAL DESIGN STUDY: VIBRATION GENERATOR TRANSIENT WAVEFORM CONTROL SYSTEM Final Report, Jul. 1968–Jun. 1969

Jay M. Le Brun and John Favour Jun. 1969 201 p refs

(Contract Nas5-15171)

(NASA-CR-119063; D2-114438-1) Avail: NTIS CSCL 13I

The results of a feasibility and conceptual design study for on-line transient waveform control of typically available electromagnetic and hydraulic vibrators are presented. The control concept is implemented with modern digital computing algorithms and the reciprocal properties of the discrete Fourier transform using a time-invariant linear system approach. Compensation for frequency dependent distortion, due to the electrical and mechanical components of the vibration test system, produces the desired arbitrary complex transient-time history at the test article. Impulse techniques were used to define the test system transfer function. Author

N71-28936* National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

INFLATABLE TETHER Patent
William C. Huber and Edwin Samfield, inventors (to NASA) Issued 25 Jun. 1968 6 p Filed 11 Aug. 1967 Cl. 244-1
(NASA-Case-XMS-10993; US-Patent-3,389,877;
US-Patent-Appl-SN-660573) Avail: US Patent Office CSCL 13G

An inflatable tether device particularly adapted for tethering objects in zero gravity environments is described. The device includes an inflatable structure comprising a pair of cup-like rigid housing sections and a tubular casing of flexible fabric bonded at its respective ends to the housing sections to provide a closed inflatable structure. For stowage, the housing sections are connectable in a lip-to-lip configuration by a releasable clamp with the fabric casing folded therein in a readily expandable condition. The structure is inflatable into a semi-rigid column by a compressed gas supply and together with shock absorber struts dampens disturbing forces and relative oscillations between the tethered objects. A modified form includes internal hatches and inflatable sealing means which adapt the tether for use as a passageway between space vehicles. Official Gazette of the U.S. Patent Office

N71-28937* North American Aviation, Inc., El Segundo, Calif.
SPHERICAL SHIELD Patent
Sheldon J. Noreen and Robert O. Pfleger, inventors (to NASA) Issued 23 Nov. 1965 3 p Filed 2 Nov. 1964 Cl. 285-45 Sponsored by NASA
(NASA-Case-XNP-01855; US-Patent-3,219,365;
US-Patent-Appl-SN-408435) Avail: US Patent Office CSCL 13I

A spherical shield device for conduits carrying high pressure fluids such as propellant lines is described for protecting a bellows joint while permitting gimbal and axial movement of the joint members. The spherical shaped sleeve is longitudinally split in half with its edges flanged and bolted together with marcel spring-type spacers between each pair of flanges. Each conduit section can gimbal and vary the angle formed between the longitudinal axis of the conduit and by loosening the bolts between the flanges the size of the shield can be varied permitting axial lengthening or shortening of the joint. The shield also carries axial tension loads on the joint. J.M.

N71-28951* North American Aviation, Inc., El Segundo, Calif.
UNIVERSAL RESTRAINER AND JOINT Patent
Ralph F. Kuhn, Jr., inventor (to NASA) Issued 12 May 1964 7 p Filed 29 Feb. 1960 Cl. 60-35.55 Sponsored by NASA
(NASA-Case-XNP-02278; US-Patent-3,132,479;
US-Patent-Appl-SN-11853) Avail: US Patent Office CSCL 13I

A mechanism for tying or restraining universal joints so as to prevent joint separation while allowing freedom of movement in bending, angulation, and lateral offset in any position about an original axis is described.
Official Gazette of the U.S. Patent Office

N71-28952* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
LINE FOLLOWING SERVOSYSTEM Patent
Eugene A. Glassey, inventor (to NASA) Issued 3 Jun. 1958 3 p Filed 27 Sep. 1956 Cl. 318-31
(NASA-Case-XAC-00001; US-Patent-3,837,706;
US-Patent-Appl-SN-612568) Avail: US Patent Office CSCL 13I

A function generator, of the curved follower type, employing a potentiometer as the sensing element, is described. This arrangement produces good servo resolution and increased precision. The generator also has a simple design and is capable of operating with a high degree of stability and accuracy. The advantages of the device over previous types are also discussed. E.H.W.

N71-28959* Douglas Aircraft Co., Inc., Santa Monica, Calif.
ENERGY ABSORPTION DEVICE Patent
Carl A. Fredrickson, inventor (to NASA) Issued 22 Feb. 1966 4 p Filed 13 Apr. 1964 Cl. 64-27 Sponsored by NASA
(NASA-Case-XNP-01848; US-Patent-3,236,066;
US-Patent-Appl-SN-359532) Avail: US Patent Office CSCL 13I

The advantageous mode of operation and structural simplicity is accomplished by providing an energy absorption device which includes an output shaft, a hollow gear which surrounds the output shaft, and a pair of springs which are connected between the hollow gear and output shaft to form a resilient driving connection. The springs are preloaded to match the maximum input torque that will be applied to either the output shaft or the hollow gear during normal operation. Thus, the energy absorption device is operative only when very high torques are applied.
Official Gazette of the U.S. Patent Office

N71-28995 Pennsylvania State Univ., University Park.
GENERAL ANALYSIS OF IDEALIZED THREE PHASE MACHINES
Joseph Eugene Dandois (Ph.D. Thesis) 1969 92 p
Avail: Univ. Microfilms Order No. 70-13813

An investigation into the general equations of an idealized ac machine is summarized. The approach used integration of the machine coil voltage equations in order to produce flux linkage equations. The balanced condition was then a special case of the unbalanced operation. The resultant flux linkage equations were transformed into current equations and these in turn were solved even with nonlinear inductance values. The instantaneous torque equation required that the inductances not enter saturation. It is shown that it is possible to analyze a general n-phase system with or without symmetrical windings. In addition, instantaneous values of three phase symmetrical components were examined and shown to be a linear combination of currents which were the i sub alpha and i sub beta currents of Clarke. If this linear transforation is used in a symmetrical three phase system an equation simplification results.
Dissert. Abstr.

N71-29018* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
METHOD OF MAKING PRESSURIZED PANEL Patent
Erskine C. White, inventor (to NASA) Issued 8 Jun. 1970 3 p Filed 21 Nov. 1968 Cl. 29-421; Int. Cl. B23p17/00
(NASA-Case-XLA-08916; US-Patent-3,583,058;
US-Patent-Appl-SN-777765) Avail: US Patent Office CSCL 13H

An apparatus and method for making relatively flat, large area pressurized meteorid penetration detector panels are described. The structure of the panels includes an interconnected cellular configuration in which the cells have spaced periphery welds and tufts in their centers at which point a spot weld is made. The panels are produced by prewelding sheets of metal together and then pressure forming them by placing them in a peripheral clamp and utilizing air pressure to expand the panel sides against two surface restricting shims.
Official Gazette of the U.S. Patent Office

N71-29032* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
METHOD OF COATING THROUGH-HOLES Patent
George L. Filip, inventor (to NASA) Issued 27 Apr. 1971 3 p Filed 15 Aug. 1968 Cl. 117-212; Int. Cl. H05k3/00; Int. Cl. B44d1/18
(NASA-Case-XMF-05999; US-Patent-3,576,669;
US-Patent-Appl-SN-752946) Avail: US Patent Office CSCL 13H

A method and apparatus for applying conductive coatings to substrate through-holes that achieves uniform results and greatly reduces coating time is presented. This is accomplished by first immersing a plurality of spaced pins in a tank of coating material. The pins are attached at one end to a plate mounted on an apparatus so that the pins can be lowered into and raised from a tank of coating material. The tank is mounted on a part of the apparatus. Coating material clings to the pins and when the pins are passed through a substrate having like spaced holes the coating material is deposited on the substrate around and in the

through-holes. The apparatus is provided with moveable substrate holder that permits positioning of the substrate between the pins and the tank of coating material. The substrate can be moved to a position such that when the pins with globules of coating material already on them are passed through the substrate the pins extend into the tank of coating material.
Official Gazette of the U.S. Patent Office

N71-29114 National Lending Library for Science and Technology, Boston Spa (England).
ELECTRON DIFFRACTION STUDY OF THE CHANGES OCCURRING ON THE FRICTION SURFACES OF A MOLYBDENUM DISULPHIDE/STEEL PAIR
V. E. Vainshtein et al 28 Oct. 1970 7 p refs Transl. into ENGLISH from Fiz.-Khim. Mekhan. Materialov, Akad. Nauk Ukr. SSR (Kiev), v. 6, 1970 p 60–63
(NLL-Risley-Trans-1989-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Results of an electron diffraction study of the changes occurring on the friction surfaces of a molybdenum disulfide/steel pair are reported. The analysis was performed to establish a link between the friction characteristics of MoS2 and the phase composition of the films forming on the friction surfaces. Experiments were conducted with friction for 6 hours and for 0.5 hours and at a sliding velocity of 1.6 m/sec. It was found that the temperature developing under friction at the points of contact and the duration of sliding have significant influence on the destruction and consequent oxidation of molybdenum disulfide films. A.C.R.

N71-29117 National Lending Library for Science and Technology, Boston Spa (England).
ANTIFRICTION GRAPHITE-CARBIDE-SILICON MATERIALS WITH HIGH WEAR RESISTANCE
A. S. Tarabanov et al 1 Jan. 1971 5 p Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Neorgan. Materialy (Moscow), v. 6, no. 4, 1970 p 833–834
(NLL-RISLEY-TRANS-1991-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupons

The preparation of an antifriction graphite-carbide-silicon material with high wear resistance is reported. The compound is intended for use in friction joints and is obtained by impregnating porous graphite with molten silicon under extremely controlled conditions. Experimental test results indicate that the siliconized graphite is the best material for operation in air, in a dichloroethane medium, or in a solution of cellulose and sulfuric acid, and that friction unit loads of up to 80 kg/sq.cm can be tolerated. It is therefore recommended for making end-face seals, step bearings, and radial slide bearings. A.C.R.

N71-29132* Marquardt Corp., Van Nuys, Calif.
TUBE SEALING DEVICE Patent
John G. Campbell, inventor (to NASA) Issued 8 Jun. 1971 4 p Filed 10 Oct. 1969 Cl. 73-49.8; Int. Cl. G01m3/04 Sponsored by NASA
(NASA-Case-NPO-10431; US-Patent-3,583,239; US-Patent-Appl-SN-865329) Avail: US Patent Office CSCL 13I

A tube sealing device particularly suited for use in sealing the opposite ends of tubular bodies during material testing operations is described, that is characterized by an elongated body having enlarged, rigidly interconnected cylindrical portions located at its opposite ends. The device is adapted to be inserted and confined within a tubular body for defining between the end portions of an hermetically sealed constant volume chamber. This provides a device adapting to confine fluid under pressure within a tubular body while obviating an application of axially directed end loads to the wall of the body. Official Gazette of the U.S. Patent Office

N71-29133* Sperry Rand Corp., Huntsville, Ala.
DEVICE FOR HANDLING PRINTED CIRCUIT CARDS Patent
Ronald L. West, inventor (to NASA) Issued 8 Jun. 1971 8 p Filed 16 Dec. 1969 Cl. 294-15; Cl. 29-278R; Cl. 81-3R; Cl. 339-17R; Int. Cl. B65g7/12 Sponsored by NASA
(NASA-Case-MFS-20453; US-Patent-3,583,744; US-Patent-Appl-SN-885594) Avail: US Patent Office CSCL 13I

A device for removing printed circuit cards from a container, such as a computer control box is described that comprises a tool having an end mechanism for engaging an adapter provided on the end of each printed circuit card. The tool firmly interlocks with the card adapter while simultaneously unlatching a spring loaded latch that secures the card in the container. Use of the tool permits removal, handling and replacement of printed circuit cards with the use of one hand. Official Gazette of the U.S. Patent Office

N71-29138* National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
TWO COMPONENT BEARING Patent
Roger W. Peters and Norris F. Dow, inventors (to NASA) Issued 8 Sep. 1959 6 p Filed 18 Apr. 1956 Cl. 308-177
(NASA-Case-XLA-00013; US-Patent-2,903,307; US-Patent-Appl-SN-579121) Avail: US Patent Office CSCL 13I

A two component bearing is described which permits a shaft held therein to both translate and rotate with a minimum of friction. The bearing possesses characteristics which enable it to be used where only extremely fine tolerances are permitted, such as in stress-strain testing machines. The shaft is carried by inner ball bearings and can move axially of itself with a minimum of frictional resistance. Also, rotation of the shaft is affected with minimum resistance due to the ability of the outer ring of ball bearings to rotate freely. Official Gazette of the U.S. Patent Office

N71-29170 National Lending Library for Science and Technology, Boston Spa (England).
EVALUATION OF RADIOGRAPHS AND THEIR IMPORTANCE FOR ASSESSING THE EFFECT OF DEFECTS ON THE FATIGUE PROPERTIES OF WELDS
O. Izdinsky 1970 9 p refs Transl. into ENGLISH of Russian conf. report G-10 Presented at 6th Intern. Conf. on Nondestructive Testing, Hanover, 1–5 Jun. 1970
(NLL-CE-Trans-5451-(9022.09); G-10) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A standard technique used in Czechoslovakia for classifying welds qualitatively into five grades depending on the defects detected on radiographs was used in this research to verify the influence of defects on fatigue properties of welds. The results were processed into diagrams which can be used to determine the values of the fatigue limit for each type of defect and grade of weld.
A.L.

N71-29179 National Lending Library for Science and Technology, Boston Spa (England).
PROCESSES OCCURRING DURING FRICTION CONTACT AND A NEW METHOD OF INVESTIGATING THEM
Oct. 1970 6 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Fiz. (Tomsk), No. 3, 1970 p 123–126
(NLL-RISLEY-Trans-1992-(9091.9F)) Avail. Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Methods for determinng the fundamental characteristics of the physical processes which occur at the contact surface of solid materials are presented. The information is used in developing strict physico-mathematical theories of friction. The mechanical and thermodynamic properties of external friction are discussed. The question of linearity or nonlinearity, conservative or dissipative nature is considered. P.N.F.

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N71-28071# General Telephone and Electronics Labs., Inc., Bayside, N.Y. Bayside Research Center.
WIDE ANGLE ROTATING MIRROR SCAN SYSTEM FOR USE IN LASER DISPLAY SYSTEM Final Report, Jun. 1969–Feb. 1970
Vernon J. Fowler and Stanley M. Reich Nov. 1970 61 p refs
(Contract F33615-69-C-1855)
(AD-721449; GT/E-TR-70-834.11; AFHRL-TR-70-32) Avail: NTIS CSCL 13/9

The program covers the design development and fabrication of a wide-angle rotating mirror scanner for use in laser display systems. A hysteresis synchronous motor designed for operation at 300,000 rpm and employing gas bearings was fabricated and tested. Operation to 240,000 rpm was achieved with ball bearings, while limited success was obtained with gas bearings. In addition, hydrostatic gas-film-lubricated bearings made from copper impregnated tungsten were fabricated and tested. Author (GRA)

N71-28236# Utah Univ., Salt Lake City.
MICROWAVE DEVICE AND PHYSICAL ELECTRONICS LABORATORY Consolidated Quarterly Report, 1 Jul.–30 Sep. 1970
L. P. Anderson, R. L. Arnold, J. M. Baird, N. E. Buholz, and L. Campbell 30 Sep. 1970 99 p refs
(Contracts F44620-68-C-0022; N00014-69-C-0345)
(AD-722016; MDL-Q34; UTEC-MD-71-007) Avail: NTIS CSCL 20/5

Contents: Optical frequency tuning by parametric operation; Carbon dioxide laser; Tunable stimulated raman laser; Ring laser studies; An impedance analysis of double-stream interaction in semiconductors; Double-stream interaction under crossed electric and magnetic fields and TRAPATT oscillator. GRA

N71-28322# Washington Univ., Seattle. Aerospace Research Lab.
GAIN KINETICS OF HIGH PRESSURE GASDYNAMIC LASERS
Walter H. Christiansen and George A. Tsongas Feb. 1971 34 p refs Submitted for publication
(Contract N00014-67-A-0103-0008)
(AD-721735; Rept-2) Avail: NTIS CSCL 20/5

A combined analytical and experimental investigation of rapidly expanded CO2 laser mixtures is described. Study of the vibrational kinetics indicates that population inversions with high vibrational energy density can be produced at high pressures by utilizing low (starved) concentrations of CO2. Scaling laws for predicting the gain of starved systems are 2 laser to probe the flow in a nozzle at the point where the Mach number is approximately four. Population inversions at static pressures as high as about one atmosphere have been observed and found to be in reasonable agreement with predictions. Author (GRA)

N71-28399# Oregon Graduate Center for Study and Research, Portland.
MULTIWAVELENGTH LASER PROPAGATION STUDY, 3 Quarterly Progress Report, 15 Dec. 1970–15 Mar. 1971
J. Richard Kerr Apr. 1971 14 p refs
(Contract N00014-68-A-0461-0001; ARPA Order 306)
(AD-721738; Rept-1154-11; QPR-3) Avail: NTIS CSCL 20/6

During this period the data described in the preceding report were processed further to yield improved information on the spectrum of multiwavelength scintillations and the validity of the hypothesis of frozen-in turbulence. Also, experiments were formulated to examine the fundamental intermittency of turbulence and scintillation phenomena. Author (GRA)

N71-28400# Hughes Research Lab., Malibu, Calif.
DAMAGE THRESHOLD STUDIES IN LASER CRYSTALS; BEAM INTENSITY PROFILE AND SELF-FOCUSING Semiannual Report
Concetto R. Giuliano, Donald F. Du Bois, Robert W. Hellwarth, and Gerald R. Rickel Jan. 1971 69 p refs
(Contract F19628-69-C-0277; ARPA Order 1434)
(AD-722074; AFCRL-71-0064; SAR-3) Avail: NTIS CSCL 20/5

The results of a number of experiments are presented which were aimed at detailed characterization of the spatial profile of the laser beam both before and after amplification. Revised values of previous damage thresholds are presented as well as the results of measurements of damage threshold as a function of lens focal length. In other experiments, the time evolution of the damage tracks in ruby and sapphire was studied using a fast streaking camera. Because of the importance of self-focusing considerations in damage studies, a detailed derivation of theoretical results reported recently by other workers is presented as an appendix. Author (GRA)

N71-28459# Missouri Univ., Rolla. Dept. of Physics.
CROSS SECTION FOR PHOTIONIZATION OF EXCITED CESIUM ATOMS Annual Report, 1 Mar. 1970–28 Feb. 1971
Kaare J. Nygaard and Robert E. Hebner, Jr. 30 Mar. 1971 64 p refs
(Contract N00014-69-C-0271)
(AD-721370; TR-2) Avail: NTIS CSCL 7/4

The cross section for photoionization of excited cesium atoms has been measured in a triple crossed-beam experiment, i.e., two light beams crossing a beam of cesium atoms. The beam of exciting radiation was produced by a GaAs laser or by a cesium hollow cathode discharge lamp. The beam of ionizing radiation was produced by a 250 watt mercury arc lamp and dispersed by a 1/3 meter monochromator. Preliminary results indicate that the cross section as a function photon energy decreases faster than in the recombination measurements of Mohler and Boeckner. The report also includes two separate articles on GaAs lasers and cesium masers. Author (GRA)

N71-28554* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SEGMENTED SUPERCONDUCTING MAGNET FOR A BROADBAND TRAVELING WAVE MASER Patent
John J. DeLuca and Larry E. Rouzer, inventors (to NASA) Issued 17 Nov. 1970 3 p Filed 2 Oct. 1968 Cl. 335-216; Int. Cl. H01f7/22
(NASA-Case-XGS-10518; US-Patent-3,541,486; US-Patent-Appl-SN-764470) Avail: US Patent Office CSCL 20E

A superconducting magnet is described that produces a staggered magnetic field and is suitable for use with a broadband traveling wave maser. Several pole pairs are mounted along a common axis and are separated or segmented by superconducting shields. A segmented return path is provided with each segment separated from its adjacent segments by a superconducting shield. The superconducting shields allow the magnets to be controlled so that there is no pulling effect between the magnets. Official Gazette of the U.S. Patent Office

N71-28584# Avco-Everett Research Lab., Everett, Mass.
FOCUSING EXPERIMENTS WITH A HIGH POWER N2/CO2 LASER Final Technical Report
James P. Reilly Apr. 1971 33 p refs
(Contract N00014-70-C-0429)
(AD-721398) Avail: NTIS CSCL 20/5

A high-power uniform electric discharge is used to produce laser action in a mixture of N2, CO2 and He. Stable and unstable resonator cavities have been used on this medium to extract large amounts of power in both single mode and multimode laser operation. At a given electrical power input and cavity coupling, no significant difference in power extraction from the cavity was measured between the stable and unstable resonators. When focused,

the power output from the unstable resonator produced focal point spot sizes and energy densities consistent with near-diffraction limited single-mode operation. Author (GRA)

N71-28888# University of Southern Calif., Los Angeles. Dept. of Electrical Engineering.
OPTICAL EXPERIMENTS WITH LASER SOURCES
Semiannual Technical Report, 30 Sep. 1970 - 28 Feb. 1971
Walter L. Faust 30 Mar. 1971 13 p refs
(Contract DAHC04-69-C-0003; ARPA Order 875-4)
(AD-721654; AROD-7871:4) Avail: NTIS CSCL 20/5

The semiannual report presents a discussion of technical findings and accomplishments for the period 30 September 1970 through 28 February 1971 covering CO2 Laser Work, CaF2H(-) Experiment, Light Scattering from Semiconductors, Associated with Impurities, and Far Infrared Work. GRA

N71-28955 Princeton Univ., N.J.
PROBLEMS IN THE COMPUTER GENERATION OF BINARY HOLOGRAMS AND SPATIAL FILTERS
Robert Alan Gabel (Ph.D. Thesis) 1969 139 p
Avail: Univ. Microfilms Order No. 70-14208

The computer generation and plotting of synthetic holograms is discussed. This procedure is attractive since the object may be defined only mathematically and need not exist physically. Also, perfect optical elements, such as point sources, lenses, an filters, can easily be simulated in the construction, and the recording step may be better controlled so as to place the operating point on a desired portion of the recording film's transmittance vs exposure curve and to compensate for non-linear film characteristics. However, degradations are introduced by the limited spatial resolution and discrete intensity levels common to the several types of equipment used to plot the hologram. These degradations may limit image quality. Dissert. Abstr.

N71-28983* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
OPTICAL COMMUNICATIONS SYSTEM Patent
Numa E. Thomas, inventor (to NASA) Issued 2 Nov. 1965 8 p
Filed 18 Apr. 1963 Cl. 250-199
NASA-Case-XLA-01090; US-Patent-3,215,842;
US-Patent-Appl-NS-274065) Avail: US Patent Office CSCL 20E

The development of a passive reflector-modulator for optical communication by means of modulated light beams is discussed. An optically reflective flexible diaphragm face or faces of a corner reflector are positioned so that upon the influence of sound waves from the speaker, modulation of a light beam occurs. The modulated light beam is received by an optical system at a distant site and converted into electrical impulses by a photodetector. The output of the photodetector is used to operate an audio amplifier for reproduction of intelligence. P.N.F.

N71-29131* National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
MULTIPLE HOLOGRAM RECORDING AND READOUT SYSTEM Patent
James N. Hallock, inventor (to NASA) Issued 18 May 1971 6 p
Filed 28 Aug. 1969 Cl. 350-3.5; Int. Cl. G02b27/22
(NASA-Case-ERC-10151; US-Patent-2,578,838;
US-Patent-Appl-SN-853856) Avail: US Patent Office CSCL 20E

An information recording and readout system is presented wherein multiple holograms are recorded in a single hologram recording medium by the use of three intersecting light beams and a lens system. Hologram patterns are formed by adding a third intersecting light beam to the two intersecting light beams normally used in hologram formation. The location of the third beam is changed for each different hologram to be formed on the medium. Readout, for the case of pattern identification, is accomplished by presenting patterns to the holographic medium and recreating and sensing the position of the third beam.
Official Gazette of the U.S. Patent Office

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N71-28013 National Lending Library for Science and Technology, Boston Spa (England).
EFFECT OF ZIRCONIUM ADDITIONS ON RELAXATION OF NICKEL
V. M. Azhazha et al Sep. 1970 10 p refs Transl. into ENGLISH from Fiz. Metal. i Metalloved. (USSR), v. 29, no. 2, Feb. 1970 p 324 - 328 In ENGLISH and RUSSIAN
(NLL-LTI-746-667-(9022.401); LTI-737-8078) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The influence of zirconium additives on the physical and mechanical properties of nickel is investigated. Investigations were also conducted for the structure and gas interaction together with the measurement of the temperature dependence of internal friction. Increases in nickel quantities lead to a reduction in the high temperature background, which correlates well with data on high temperature stability. E.H.W.

N71-28039# Scientific Research Atomic Reactor Inst., Melekess (USSR).
EFFECT OF INITIAL HEAT TREATMENT ON THE MECHANICAL PROPERTIES OF HIGH NICKEL ALLOYS AFTER NEUTRON IRRADIATION [VLIYANIE ISKHODNOI TERMOOBRABOTKI NA MEKHANICHESKIE SVOISTVA VYSOKONIKELEVYKH SPLAVOV POSLE NEITRONNOGO OBLUCHENIYA]
S. N. Votinov, V. M. Masl'uk, V. D. Balashov, E. E. Ostrovski, V. K. Shamardin et al 1970 26 p In RUSSIAN
(SRARI-P-80) Avail: AEC Depository Libraries

The effects of initial heat treatment on high temperature embrittlement after irradiation were investigated on nickel alloys such as XH78T10P, X20H78T, and XH60B. It is shown that the states characterized by continuous precipitate walls along the boundaries and by the presence of gamma phase precipitates inside the grains embrittle to a great extent after irradiation.
Author (NSA)

N71-28040*# General Electric Co., Cincinnati, Ohio.
REFRACTORY METAL VALVES FOR 1900 DEG F SERVICE IN ALKALI METAL SYSTEMS
R. W. Harrison and J. Holowach Washington NASA May 1971 166 p refs
(Contract NAS3-8514)
(NASA-CR-1810; GESP-508) Avail: NTIS CSCL 11F

Refractory metal metering and isolation valves were designed and evaluated in a forced circulation lithium loop operated at a maximum temperature of 2100 F for 5000 hours in an ultra-high vacuum environment. The valves, which were exposed to a maximum temperature of 1900 F, were cycled during testing to simulate actual operation. Rhenium seats and W-25Re plugs were employed to prevent diffusion bonding during testing. Posttest evaluation of the valve components indicated the materials were compatible with the alkali metal environment and no degradation had occurred as a result of valve operation. Sheet tensile specimens of T-111, T-222, ASTAR 811, ASTAR 811C, ASTAR 811CN, and W-Re-Mo Alloy 256 were placed in a portion of the loop circuit

which operated at a maximum temperature of 2100 F with a 200 F temperature drop along the length of the specimen containment tube. Metallurgical evaluation of these specimens indicated no alkali metal attack. The results of room temperature and 2000 F tensile tests following the 5000 hour exposure showed no changes in strength or ductility that could be attributed to the lithium exposure. Author

N71-28072# Japan Atomic Energy Research Inst., Tokyo.
PROCESS OF CARBURIZATION IN AUSTENITE STAINLESS STEEL
Gunji Nishio and Junichi Shimokawa Sep. 1970 23 p refs
(JAERI-4132) Avail: AEC Depository Libraries

The investigations were made to provide basic information on the compatibility between the carbide fuel and austenitic stainless steel cladding. The apparent volume and grain boundary diffusion coefficients for 304 stainless steel were measured by means of C-14 tracer with the instantaneous source model by the standard sectioning technique. The two apparent diffusion coefficients were represented as a function of temperature. The high activation energies found may be due to the sink effect caused by the carburization of chromium in the stainless steel. The diffusion kinetics and mechanism of carburization in stainless steel were also investigated. The penetration profiles obtained by C-14 monitoring at 650 to 830 C are relatively good agreement with the theory of grain boundary diffusion. By comparing results of experiments and theory, the carbon concentration between the graphite and polished surface of the stainless steel may be kept by thermodynamic balance. The depth of carburization appeared to follow the logarithmic law as a function of the annealing time. Author (NSA)

N71-28073# Stanford Research Inst., Menlo Park, Calif.
DEVELOPMENT OF ULTRAHIGH STRENGTH, DUCTILE TITANIUM ALLOYS BY THERMOMECHANICAL PROCESSING AND TRANSFORMATION INDUCED PLASTICITY Summary Report, 1 Jan. - 31 Dec. 1970
D. Weinstein Feb. 1971 38 p refs
(Contract N00019-70-C-0117)
(AD-721361) Avail: NTIS CSCL 11/6

By analogy with trip steels, which attain high strength combined with high tensile elongation, it should be possible to devise a titanium alloy where beta phase is retained such that martensitic start = or = room temperature = or = martensitic decomposition and martensitic transformation occurs during deformation. If this condition can be achieved in a highly strengthened retained beta, it is possible that, for a given yield strength, the alloy could exhibit enhanced tensile elongation and fracture toughness. This report summarizes experimental results of the first year of a program for development of a TRIP-type titanium alloy. Author (GRA)

N71-28131# Martin Marietta Corp., Denver, Colo.
THE EFFECTS OF THE SURFACE LAYER ON PLASTIC DEFORMATION AND CRACK PROPAGATION Semiannual Report
Irvin R. Kramer Mar. 1971 15 p
(Contract DAAG46-70-C-0102; ARPA Order 180)
(AD-721292; CR-71-2; AMMRC-CR-71-2/1) Avail: NTIS CSCL 11/6

The report describes the effect of a surface layer on the rate of crack propagation and, based on this knowledge, the author proposes to improve the crack propagation resistance of metals used in pressure vessels. The qualification of pressure vessel hardware is usually achieved by the proof test method. The maximum size of the flaw that is present can be predicted from fracture mechanics. However, cracks can grow below the critical stress intensity K(c) and can cause leak failure. Therefore, the subcritical crack growth characteristics of metals are important in pressure vessel material selection. An evaluation of the crack growth rate under sustained or cyclic loading under the service stress gives a measure of reliability of the hardware. Author (GRA)

N71-28163*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CYCLIC OXIDATION RESISTANCE OF CLAD IN-100 AT 1040 C AND 1090 C: TIME, CYCLE FREQUENCY, AND CLAD THICKNESS EFFECTS
Michael A. Gedwill Washington Jun. 1971 43 p refs
(NASA-TN-D-6276; E-6108) Avail: NTIS CSCL 11F

Furnace oxidation studies were conducted on nickel alloy IN-100 specimens clad with Ni-20Cr-4Al-1.2Si, Fe-25Cr-4Al-1Y, and Ni-30Cr-1.4Si foils (0.051 to 0.254 mm thick). The Ni-Cr-Al-Si cladding was the most protective on IN-100 at both temperatures and was rather insensitive to cladding thickness in the range studied, to cycle frequency, and to exposure time up to 400 hours. The protection offered by the Ni-Cr-Al-Si cladding was comparable to that provided by a commercial aluminide coating. The Fe-Cr-Al-Y cladding was moderately protective and the Ni-Cr-Si was least protective. The performance of all three cladding systems was affected by interdiffusion with IN-100. Author

N71-28180# Joint Publications Research Service, Washington, D.C.
EFFECTS OF HIGH POWER RADIATION ON METALS
S. I. Anisimov et al 27 May 1971 246 p refs Transl. into ENGLISH of the book 'Deystviye Izlucheniya Bolshoy Moshchnosti na Metally' Moscow, Nauka Publishing House, 1970 p 1-272
(JPRS-53241) Avail: NTIS

An orderly summation of experimental and theoretical results and conclusions concerning the physics and effects of high power radiation on matter is presented. The literature review contains a brief presentation of the most significant experimental and theoretical works published through mid-1968 and is limited to studies of condensed matter with high initial coefficients of absorption and with energy flux densities up to 10 to the 13th power w/sq cm. Problems related to the heating and breakdown of gases under the influence of laser radiation and nonlinear optics are not included. J.M

N71-28181# Midwest Research Inst., Kansas City, Mo.
THE INITIATION AND GROWTH OF FATIGUE CRACKS IN FILAMENT-REINFORCED ALUMINUM ALLOYS Technical Report, 1 Apr. 1969 - 28 Feb. 1971
J. R. Hancock Mar. 1971 34 p refs
(Contract N00014-70-C-0212)
(AD-722009; TR-1) Avail: NTIS CSCL 11/4

The low-cycle fatigue behavior of filamentary composites of 1235 aluminum-beryllium, 6061 aluminum-beryllium, and 7075 aluminum-boron were compared. The effects of the strength and ductility of the filaments and matrix, and the role of interfaces on fatigue hardening, and on fatigue-crack initiation and growth were evaluated to develop guidelines for the design of fatigue-resistant composites. Generally, brittle filaments, a ductile matrix, weak interfacial bonds, and a large modulus difference between constituents are the factors which lead to greater fatigue resistance in filament-reinforced metals. The observed modes of fatigue-crack growth confirmed the theoretical predictions of the effects of stress distribution at a crack tip at an interface, and extended the applicability of these predictions to filamentary composites. Author (GRA)

N71-28184# Midwest Research Inst., Kansas City, Mo.
EFFECTS OF INTERFACES ON THE OFF AXIS AND TRANSVERSE TENSILE PROPERTIES OF BORON REINFORCED ALUMINUM ALLOYS
G. D. Swanson and J. R. Hancock Apr. 1971 27 p refs
(Contract N00014-70-C-0212)
(AD-722020; TR-2) Avail: NTIS CSCL 11/4

Tension specimens of boron-reinforced 7075 aluminum and 6061 aluminum were tested at angles of 0, 30 and 90 degrees to the unidirectionally aligned filaments. Metallurgical structures in the matrix and at interfaces were correlated with the stress-strain curves, with acoustic emission from boron-filament breakage during the tests, and with fractographic studies. The effects of aging heat treatments and subzero cooling on tensile properties were related primarily to the changes in metallurgical structures produced in the 7075 aluminum matrix. The filament-matrix interfacial bond strengths exceeded the strength of the matrix alloys. Mildly degraded boron filaments had no apparent effect on the ultimate tensile strength parallel to the filaments but drastically altered the fracture mode in off-axis tensile specimens of 7075 aluminum-boron. In the 0 degree samples, fracture appeared to initiate in the core of boron filaments or at the core-boron interface. Diametral splitting of boron filaments was concluded to occur as a result of the stress state developed in the filaments during their manufacture, and limited the ultimate stengths of off-axis and transverse tension specimens. Author (GRA)

N71-28191# Avco Lycoming Div., Stratford, Conn.
FEASIBILITY STUDY OF COLOMBIUM ALLOY CASTINGS Quarterly Progress Report, 1 May – 31 Oct. 1970
R. J. Beauregard and J. J. Walters Jan. 1971 34 p
(Contract DAAG46-69-C-0163)
(AD-721308; AMMRC-CR-70-5/4; Rept-2195.8.8) Avail: NTIS CSCL 11/6

The purpose of the program is to determine the feasibility of investment-casting colombium alloys. Thirty-four castings are scheduled to be produced, using consumable-electrode arc-melting and tungsten interfaced molds to prevent mold-metal reaction. Phase I of this program concerns the optimization of mold design and preheat temperature. Phase II envisages the production of sound test specimens, followed by coating, and an environmental and mechanical testing effort. Author (GRA)

N71-28205# Technische Hogeschool, Delft (Netherlands). Afdeling der Technische Natuurkunde.
HOMO-EPITAXIAL CRYSTAL GROWTH DURING ELECTROCRYSTALLIZATION OF COPPER [HOMO-EPITACTISCHE KRISTALGROEI BIJ ELEKTROKRISTALLISATIE VAN KOPER]
Wilhelmus Antonius Schultze (Ph.D. Thesis) Jun. 1970 152 p refs In DUTCH; ENGLISH summary
Avail: NTIS

The electrocrystallization of copper from 0.8 m CuSO4 and 0.3 m H2SO4 electrolyte on a copper cathode was investigated. Secondary reactions were not observed during the deposition phenomenon. Special attention has been paid forms of homo-epitaxial crystal growth. ESRO

N71-28323# Technische Hogeschool, Delft (Netherlands). Afdeling der Technische Natuurkunde.
EQUILIBRIA, REACTIONS, AND SINTERING IN SYSTEMS WITH IRON OXIDE AS ONE OF THE COMPONENTS
Petrus Josephus Louisa Reijnen (Ph.D. Thesis) Jul. 1969 29 p refs
Avail: NTIS

The role of point defects in solid state equilibria, solid state reactions, and sintering is analyzed for the MgO-FeO-Fe2O3 ternary system. ESRO

N71-28325# Technische Hogeschool, Delft (Netherlands). Afdeling der Technische Natuurkunde.
STATISTICAL THERMODYNAMICS OF VACANCIES IN BINARY ALLOYS
Frederik Willem Schapink (Ph.D. Thesis) May 1969 132 p refs
Avail: NTIS

The properties of vacancies in binary alloys are dealt with according to the Ising model. This model is based on the hypothesis that only nearest neighbor interactions between atoms occur. The lattice vibrations are left out of consideration. The statistical thermodynamics of such a system with two components is known to be extremely complicated and hence only approximate solutions exist. The behavior of vacancies as a fluid component is studied for disordered as well as several types of ordered systems. ESRO

N71-28395 National Lending Library for Science and Technology, Boston Spa (England).
ELECTROPHORETIC DEPOSITION OF POLYETHYLENE. 1: ELECTROKINETIC POTENTIAL AND ELECTROPHORETIC DEPOSITION OF POLYETHYLENE ON METALS IN ORGANIC MEDIA
J. Miksys Oct. 1969 7 p refs Transl. into ENGLISH from Lietuvos TSR Mokslu Akad. Darbai: Ser. B (Vilnius), no. 1, 1969 p 101 – 107 In RUSSIAN and ENGLISH
(NLL-LTI-746/331-(9022.401); LTI-734-2906) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Investigatons were carried out in nitromethane, dimethyl formamide, and aliphatic alcohols dispersion mediums. The potential was measured by the electro-osmotic method. Polyethylene was deposited on Pt, Ni, Cu, Fe, and Al plates at 600 V. The magnitude of electrokinetic potential and electrodeposition of polyethylene on metals was determined to depend on the quantity of mineral contaminations in polythylene, the nature of the medium, and the electrodes. There was no relationship between the dielectrical properties of the medium and the electrokinetic properties of polyethylene. Author

N71-28401# George Washington Univ., Washington, D.C. Inst. for the Study of Fatigue, Fracture and Structural Reliability.
THE USE OF HIGH POWER ULTRASONICS (MACROSONICS) IN STUDYING FATIGUE IN METALS
Warren P. Mason and Douglas E. Macdonald Mar. 1971 22 p refs
(Contract N00014-67-A-0214-0011)
(AD-721729; TR-6) Avail: NTIS CSCL 11/6

High power ultrasonics has been a useful tool in studying fatigue in metals since a large number of cycles can be obtained in a small time. In the case of brass and iron the mechanisms appear to be different since at the high frequencies fatigue occurs in isolated regions whereas at the low frequencies the slip is generally spread over the grains. The same mechanism can be produced at high frequencies by going to higher temperatures. In iron the stress required for fatigue at higher frequencies is considerably less than for low frequencies. Recent measurements in titanium have shown that the required stress is about the same for high and low frequencies. The crack propagation velocity, however, is much faster at the ultrasonic frequencies. This was proved by striation measurements with a scanning electron microscope. Thus, the high frequency fracture is not only localized, it is virtually catastropic in the localized area. Author (GRA)

N71-28433# California Univ., Los Angeles. School of Engineering and Applied Science.
NEW TECHNIQUES FOR THE SYNTHESIS OF METALS AND ALLOYS, AND THE PROPERTIES OF RARE EARTH METALS AND ALLOYS Semiannual Technical Report
R. F. Bunshah and D. L. Douglass Mar. 1971 81 p refs
(Grant DAHC15-70-G-0015; ARPA Order 1643)
(AD-722088; UCLA-eng-7112; SATR-1) Avail: NTIS CSCL 13/8

Two major areas of effort are encompassed: New techniques for the synthesis of metals and alloys. The report describes the HRPVD (The high rate physical vapor deposition) apparatus. Models for calculation of temperature and thickness distribution of the

deposit are given. The properties of rare earth metals and alloys. The research was directed at obtaining an understanding of the mechanisms and to characterize the oxidation behavior of Ni-20Cr containing, Gd, La and Y and alloys based on the composition Ni3Al. GRA

N71-28441# Drexel Univ., Philadelphia, Pa. Dept. of Metallurgical Engineering.

MECHANICAL BEHAVIOR OF ALUMINUM STAINLESS STEEL COMPOSITES SUBJECTED TO ELEVATED TEMPERATURE EXPOSURE

A. Pattnaik and A. Lawley Mar. 1971 10 p refs
(Contract N00014-67-A-0406-0001)
(AD-721374; TR-6) Avail: NTIS CSCL 11/4

Room temperature tensile behavior to failure is correlated with associated interface microstructure, matrix substructure, and fracture morphology in aluminum-stainless steel composites (Vf = 6.5%,19.6%) in the as-pressed condition and after exposure at temperatures of 550C or 625C. Heat-treatment at either temperature does not affect stages I and II of the stress-strain curve but does reduce the ultimate tensile strength; strain to failure is not impared after the 550C heat-treatment but is significantly lower following heat-treatment at 625C. These observations are consistent with the observed fracture morphology of composites and wires pulled to failure after extraction from the composites. A corn-cob structure develops on the wire surface at each temperature; ductile behavior of the wires is confirmed after heat-treatment at 550C but not after heat-treatment at the higher temperatures. Reduction in strength is attributed to the development of a brittle interfacial zone. Composite tensile strengths in the three conditions are in reasonable agreement with rule-of-mixtures predictions using measured strength levels for the extracted wires in the calculation. In each condition, a dislocation cell structure develops in stage III with the cell size relatively independent of distance from the matrix-wire interface; the cell structure is comparable to that formed in unreinforced aluminum at comparable levels of strain. Author (GRA)

N71-28442# National Academy of Sciences - National Research Council, Washington, D.C. Committee on Nuclear Science.

RADIOCHEMISTRY OF TITANIUM

Vincent J. Landis (San Diego State Univ.) and James H. Kaye (Battelle-Northwest, Richland, Wash.) AEC Jan. 1971 91 p refs Revised
(NAS-NS-3034-Rev) Avail: NTIS

The inorganic chemistry of titanium, hazards and precautions in handling titanium-containing materials, counting techniques, and radiochemical separation procedures are discussed. NSA

N71-28443# General Motors Research Labs., Warren, Mich.

ANALYSIS OF ELASTIC/VISCO-PLASTIC WAVES OF FINITE UNIAXIAL STRAIN Topical Report of the Predix Research Program

R. J. Clinton (Brown Univ.) Jan. 1971 82 p refs
(Contract DASA01-68-C-0114)
(AD-721368; MSL-70-32; DASA-2578) Avail: NTIS CSCL 11/6

An approximate theory is presented for waves of small but not infinitesimal strains. The approximation introduced is the representation of the specific internal energy by an expansion to third order terms in elastic strains and entropy. Isotropic materials are assumed for which the coefficients in the expansion of the internal energy can be determined from ultrasonic measurements of the variation of the longitudinal and shear wave speeds with hydrostatic pressure, uniaxial stress, and temperature. Wave profiles are computed for two plastic strain-rate functions developed to model 6061-T6 aluminum. Computations are carried out using a difference method which treats the jumps at the elastic precursor explicity and is essentially a second-order accurate method in the continous wave region behind the wavefront. The computed profiles illustrate the details of the profiles near the wave front and at early times. Author (GRA)

N71-28449# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Reaktorbauelemente.

EXPERIMENTAL INVESTIGATION OF THE WEAR CHARACTERISTICS OF STEEL AND ALLOYS IN LIQUID SODIUM [EXPERIMENTELLE UNTERSUCHUNGEN DES VERSCHLEISSVERHALTENS VON STAEHLEN UND LEGIERUNGEN IN FLUESSIGEM NATRIM]

E. Wild, K. Mack, and H. Hoffmann Aug. 1970 46 p refs In GERMAN; ENGLISH summary
(KFK-1251) Avail: AEC Depository Libraries

The wear due to operation of bearings, guides, supports, and holders of components of sodium-cooled reactors can be limited to a large extent or reduced to a minimum by the choice of suitable material combinations. This requires knowledge of the sliding and wear behavior of a maximum number of material combinations which can be set up from structural materials, hard facing alloys and hard metals and whose compatibility with the operating medium has been proved. The type of wear investigations deemed to be useful in view of the problem points the related questions of materials and the experimental facility used are described. Author (NSA)

N71-28450# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).

PARAMETRIC EXPERIMENTAL INQUIRY ON FRETTING CORROSION IN METALS [INDAGINE SPERIMENTALE PARAMETRICA SULLA FRETTING CORROSION IN MATERIALI METALLICI]

P. Lupoli 1 Jul. 1970 36 p refs In ITALIAN
(RT/ING-(70)14) Avail: AEC Depository Libraries

An experimental study on fretting corrosion of stainless steel-copper and stainless steel-Zircaloy 2 pairs in water at ambient temperature was carried out. During test the contact pressure was varied between 50 and 250 kg/sq cm and the frequency of relative motion between 0.6 and 130 cps. The results obtained are analyzed and discussed. Author (NSA)

N71-28453# Army Weapons Command, Rock Island, Ill. Research and Engineering Directorate.

STRUCTURAL STABILITY OF A CAST Co-Cr-Mo ALLOY DURING IMPULSIVE THERMAL MECHANICAL LOADING

William T. Ebihara Dec. 1970 35 p refs
(AD-721895; AMSWE-RE-70-197) Avail: NTIS CSCL 19/6

The response of a cast cobalt-base alloy to impulsive thermal-mechanical fatigue conditions, present during the firing of automatic weapons, was examined. The study indicates that a variety of structural alterations take place near the interior gun bore surface that are dependent upon the firing schedule and the ammunition used. Surface-layer melting and Stage I type of fatigue cracks are noted for the larger caliber inserts. Extensive slip-deformation and work-hardening in the surface areas were attributed to the interior ballistics conditions as well as to the prior machining operations. The stress-induced transformation phenomenon in the matrix and the precipitation in the slip zones related to the enhancement of wear resistance are discussed. Author (GRA)

N71-28454# Rensselaer Polytechnic, Troy, N.Y. Materials Div.

AN ELECTRON MICROPROBE ANALYSIS OF SOLUTE SEGREGATION NEAR GRAIN BOUNDARIES IN AN Al-Zn-Mg ALLOY

C. R. Shastry and G. Judd 15 Apr. 1971 23 p refs
(Contract N00014-67-A-0117-0009)
(AD-722034; TR-2) Avail: NTIS CSCL 11/6

The concentration of zinc and magnesium across grain boundaries was measured by means of an electron probe microanalyser for an Al-Zn-Mg alloy after different quenching (brine, water, oil and air) and aging heat treatments (room temperature,

165C and 200C). Significant solute segregation was detected in quenched specimens and also in specimens that were aged at room temperature. While no segregation was measured in specimens that were aged at elevated temperatures, solute depletion was observed in a considerable proportion of the examined boundaries. It was concluded that solute segregation to grain boundaries occurred during quenching and was relieved during aging. Author (GRA)

N71-28502# Cincinnati Univ., Ohio. Dept. of Materials Science and Metallurgical Engineering.

THERMODYNAMICS OF VANADIUM ALLOYS. PART 2. MASS SPECTROMETRIC DETERMINATION OF THERMODYNAMIC PROPERTIES OF VANADIUM-TITANIUM-CHROMIUM ALLOYS Final Report, Jan. 1969 – Apr. 1970

M. Hoch, C. J. Oblinger, and Edmund J. Rolinski (AFML, Wright-Patterson AFB, Ohio) Wright-Patterson AFB, Ohio AFML Oct. 1970 98 p refs

(Contract F33615-67-C-1565)

(AD-720287; AFML-TR-70-119-Pt-2) Avail: NTIS CSCL 11/6

The Knudsen effusion method was combined with a mass spectrometer sensing technique in order to measure theremodynamic quantities of solid solution alloys of V-Ti-Cr in the b.c.c. (beta) phase. The technique makes use of the regular solution model in order to treat the vaporization data in terms of ion current ratios obtained from the mass spectrometer. The incipient melting points of twenty two ternary alloys were determined. The temperature range of the vaporization experiments was limited from 1400 to 1700C for alloy compositions ranging from 10 to 66 atomic percent of each of the three components of the ternary system. Within the experimental temperature range, a regular solution model modified for ternary interactions represented the thermodynamic behavior in the b.c.c. (beta) phase. Interaction parameters for Ti-C, V-Cr, and Ti-Cr were found to be temperature independent. However, a temperature dependent interaction parameter was determined for the Ti-Cr system when the ternary alloy data and data on the binary system in the literature were combined. An expression for the temperature dependent interaction parameter for the Ti-Cr system was obtained using both binary and ternary alloy data. The experimental results on the interaction parameters agree with calculated estimates from phase diagrams and theoretically calculated values. Author (GRA)

N71-28503# Cincinnati Univ., Ohio. Dept. of Materials Science and Metallurical Engineering.

THERMODYNAMICS OF VANADIUM ALLOYS. PART 3. RELATIVE IONIZATION CROSS SECTIONS OF TRANSITION METALS USING TIME-OF-FLIGHT MASS SPECTROMETRY Final Report, Jan. 1969 – Apr. 1970

M. Hoch, C. J. Oblinger, and Edmund J. Rolinski (AFML, Wright-Patterson AFB, Ohio) Wright-Patterson AFB, Ohio AFML Oct. 1970 26 p refs

(Contract F33615-67-C-1565)

(AD-720288; AFML-TR-70-119-Pt-3) Avail: NTIS CSCL 11/6

The ion current ratio data, treated using a modified form of the regular solution model, can be used to calculate relative electron impact ionization cross sections. Although this was not the primary reason for this research, the method outlined indicates that the ion current ratio data are thermodynamically consistent. The method outlined, while based on experimental ion current ratio data, makes use of absolute vapor pressure data from other sources and shows the dependency of calculated cross sections on these vapor pressure measurements. Thus, the calculation of relative electron impact ionization cross sections seems to be as good as available data on absolute vapor pressure measurements. Author (GRA)

N71-28504# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

DRY CORROSION AND PROTECTION OF Zr AND ITS ALLOYS [CORROSION SECHE ET PROTECTION DU ZIRCONIUM ET DE SES ALLIAGES]

R. Darras 1970 49 p refs In FRENCH Presented at the Meeting on Corrosion, Toulouse, 26 – 27 May 1970

(CEA-CONF-1728; CONF-701040-1) Avail: AEC Depository Libraries

Long term exposure of Zr to CO2 at temperatures above. 500 C results in destructive oxidation. Two features are associated with oxidation: the development of a superficial layer of oxide, which is very sensitive to fissuration, and the dissolution of oxygen into the bulk of the metal which makes it fragile. Zr-Cu alloys containing between 1.6 and 3% Cu (by weight) were studied. The corresponding oxidation kinetics are parabolic until a temperature of at least 650 C is reached, the optimum composition being about 2.5%. The addition of Cu limits significantly the absorption of hydrogen in the presence of low water vapor concentrations. The increased fragility due to the dissolution of oxygen in Zr can be avoided by using very thin protective metallic coatings. The superiority of Zr-Cu alloys is discussed. NSA

N71-28505# Martin Marietta Corp., Baltimore, Md. Research Inst. for Advanced Studies.

CHARACTERIZATION OF METAL SURFACES

R. M. Latanision Apr. 1971 69 p refs

(Contract N00014-70-C-0255)

(AD-722013; RIAS-TR-71-08C; TR-2) Avail: NTIS CSCL 7/4

Some aspects of the surface physics and chemistry of metals are examined in order to illustrate that metal surfaces are likely to be structurally, chemically, and/or electronically distinct from the bulk of the crystal. The nature of a metal surface functioning as an electrode is also considered in terms of charge double layer effects, etc. Throughout, the relevance of surface properties to mechanical behavior is made explicit. Author (GRA)

N71-28552# Army Material and Mechanics Research Center, Watertown, Mass. Ceramics Div.

CHARACTERIZATION OF HOT PRESSED Al2O3 WITH A Mo-DISPERSED PHASE

Jacob J. Stiglich, Jr., David T. Rankin, D. R. Petrak, and Robert Ruh Dec. 1970 22 p refs

(AD-722239; AMMRC-TR-70-35) Avail: NTIS CSCL 11/2

Compositions of alumina with a molybdenum-dispersed phase were investigated in the 0 to 5 volume percent Mo range. These compositions were also prepared with a 0.5 weight percent MgO addition. All specimens were fabricated by hot pressing and near theoretical densities were achieved. Specimens were characterized by metallographic and X-ray diffraction analyses, and the microhardness, elastic moduli, tensile strength, and fracture energy were determined. Results revealed that Mo additions did not affect grain growth while in contrast, MgO additions significantly inhibited grain growth. However, Mo additions did reduce the elastic moduli and microhardness, but did not measuresbly affect the tensile strength. A 50% increase in fracture energy was found in the Al2O3 + 5% Mo composition compared with Al2O3. In addition, specimens were successfully hot pressed with a microstructure graded from Al2O3 to the 5% Mo composition. Author (GRA)

N71-28553# Army Materials and Mechanics Research Center, Watertown, Mass.

METAL MATRIX COMPOSITES BY DECOMPOSITION SINTERING OF TITANIUM HYDRIDE

Jacob Greenspan, Fortunato J. Rizzitano, and Eraldus Scala Dec. 1970 22 p refs

(AD-722258; AMMRC-TR-70-33) Avail: NTIS CSCL 11/4

Titanium hydride powders were pressure sintered in vacuum, and spontaneously decomposed, giving compacts of titanium metal. Under these conditions lower temperatures were required for sintering than are normally needed for titanium metal powders. The

method, therefore, was investigated for its applicability to titanium matrix composites in order to minimize chemical reactivity problems generally encountered in processing materials of this kind. Models containing tungsten and stainless steel wire reinforcement were synthesized this way, and some tensile properties were determined. To this extent, process feasibility is indicated. An important aspect is matrix ductility, maintained by impurity control, as needed for titanium. The present models are seen to be ductile fiber-ductile matrix systems. Author (GRA)

N71-28610# Battelle Memorial Inst., Columbus, Ohio.
PROGRESS ON LMFBR CLADDING, STRUCTURAL, AND COMPONENT MATERIALS STUDIES Quarterly Report, Oct. –Dec. 1970
Donald L. Keller Jan. 1971 34 p refs
(Contract W-7405-eng-92)
(BMI-1896) Avail: NTIS

Creep tests at 650 C of type 316 stainless steel, shock hardened by means of a flyer plate, show a continuous decrease in minimum creep rate with increase in shocking pressure. As observed with tensile property changes, contact explosive shocking achieves greater strengthening than does shocking by means of a flyer plate for equivalent calculated shocking pressures. Additional creep-rupture data were obtained on low-carbon ferritic 2-1/4 Cr-1 Mo steel specimens. Low-cycle strain-controlled fatigue tests were conducted on solution-annealed Incoloy 800 specimens at 1000, 1200, and 1400 F. Eight specimens were tested with hold times at the tensile strain limit only. The specimens exhibited significantly lower fatigue lives than specimens tested earlier with no hold times. An analysis of the cyclically stable stress-relaxation curves for solution-annealed Incoloy 800 was completed. Author (NSA)

N71-28613# Howard Univ., Washington, D.C. Dept. of Physics.
RADIATION DAMAGE IN OPTICALLY TRANSPARENT MATERIALS (ZIRCONS) Progress Report
Arthur N. Thorpe Feb. 1971 46 p refs
(Contract AT(40-1)-4049-001)
(ORO-4049-1) Avail: NTIS

The IR spectral measurements were made on alpha-recoil-damaged natural zircons from Ceylon. A preprint manuscript is appended. The results, obtained for both powders and thin plates, confirm the macroscopic model of Pellas. Characteristics of the powder and thin-plate spectra and annealing effects are listed. Other studies in progress include thermal analysis, shock experiments, electron microscopy, thermoluminescence, and iron content. NSA

N71-28616# Watervliet Arsenal, N.Y.
THE BAUSCHINGER EFFECT IN A SERIES OF NICKEL-COBALT ALLOYS
R. Vincent Milligan Mar. 1971 23 p refs
(AD-722233; WVT-7111) Avail: NTIS CSCL 11/6

A commercially pure nickel and four different polycrystalline nickel-cobalt alloys were overstrained various amounts up to 5% in tension and reverse strained in compression. The Bauschinger strain, according to Wooleys definition, was determined and found to be dependent on the amount of plastic strain and the composition. Author (GRA)

N71-28624# Utah Univ., Salt Lake City.
FUNDAMENTALS OF RADIATION DAMAGE Technical Progress Report, 1 Feb. 1970 –1 Feb. 1971
A. Sosin 1971 15 p
(Contract AT(11-1)-1800)
(COO-1800-13) Avail: NTIS

The temperature dependence of the effects that electron irradiation has on the internal friction and Young's modulus in high purity and commercial copper were investigated. It was found that internal friction increases due to electron irradiation at a slower rate than changes in the modulus. Author

N71-28730# Joint Publications Research Service, Washington, D.C.
FORCE OF ICE COHESION WITH SOME METALS [O SILE STSEPLENIIA LDA S NEKOTORNYNI METALLAMI]
M. A. Dolov et al [1971] 8 p refs Transl. into ENGLISH from Tr. Vysokogornyi Geofiz. Inst. (Nalchik), no. 16, 1970 p 118–123 Prepared for Army Cold Regions Res. and Eng. Lab.
(AD-722106) Avail: NTIS CSCL 8/12

Based on an analysis of test data, it is established that: (1) force of ice cohesion with various materials depends on the type of material, condition of its surface and the temperature; (2) force of ice cohesion increases at a decrease in temperature and an increase in roughness of surface; and, (3) force of ice cohesion depends on ice structure and rate of increase of external load. The faster the rate of load increase, the greater the value of cohesion force. At gradual loading, the viscous-plastic properties of ice are manifested. Author (GRA)

N71-28747* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
FLUID IMPERVIOUS BARRIER INCLUDING LIQUID METAL ALLOY AND METHOD OF MAKING SAME Patent
Albert J. Bauman, inventor (to NASA) Issued 18 May 1971 6 p Filed 29 May 1968 Cl. 161-89; Int. Cl. D06q1/04 Sponsored by NASA
(NASA-Case-XNP-08881; US-Patent-3,579,412; US-Patent-Appl-SN-732922) Avail: US Patent Office CSCL 11F

A flexible barrier membrane is described which comprises a porous substrate and incorporates liquid metal, providing structures highly impervious to gases and liquids and self-sealing to small punctures. Fabrics of metal or synthetic textile are impregnated with low melting alloys, such as gallium or indium, and used as sealant barriers for spacecraft walls and as flexible membrane barriers for pumping liquid propellants.
Official Gazette of the U.S. Patent Office

N71-28748# Shock Hydrodynamics, Inc., Sherman Oaks, Calif.
NUMERICAL CALCULATIONS OF HYPERVELOCITY IMPACT CRATER FORMATION IN HARD AND SOFT ALUMINUM ALLOYS
M. Rosenblatt Wright-Patterson AFB, Ohio AFML Feb. 1971 79 p refs Prepared in cooperation with Dayton Univ., Ohio
(Contract F33615-68-C-1138)
(AD-721468; AFML-TR-70-254) Avail: NTIS CSCL 11/6

The wave propagation and crater growth characteristics in hypervelocity impact events on 1100-0 and 7075-T6 aluminum alloys are analyzed using a two-dimensional Eulerian numerical code called STEEP. The material model used in the calculations includes work hardening and thermal softening effects. Impacts of .635 cm aluminum spheres into semi-infinite targets at 7 km/sec and 4 km/sec are treated. Analytical predictions which can be compared directly with experimental results include crater growth characteristics and peak stress wave propagation and decay characteristics. Also included in the report are velocity field plots and principal stress field plots at selected times. The velocity magnitude, pressure, and normal stress are also plotted versus time at selected target locations. The numerical calculations show that material strength is important in determining the crater growth characteristics and final crater dimensions for the cases treated. Author (GRA)

N71-28749# McDonnell-Douglas Astronautics Co., Richland, Wash. Donald W. Douglas Labs.
PLUTONIA/CURIA COMPATIBILITY TESTING Quarterly Report, Jul. –Sep. 1970
R. L. Andelin and J. D. Watrous Oct. 1970 26 p

(Contract AT(45-1)-2138)
(MDC-G-2026; QR-8) Avail: NTIS

Conclusions reported previously for plutonia/refractory metal compatibility were reaffirmed by electron microprobe analysis. Exposure continues at 1800 and/or 2000 C on plutonia-238/refractory metal, curia-244/refractory metal, and plutonia-molybdenum cermets. Materials were ordered for initiating a more systems-oriented test program using either plutonia-molybdenum cermets or plutonia solid-solution cermets in refractory metal containers. An analysis was made of the extent and effects of oxygen uptake in the Ta-10W liner and T-111 strength member for the Pioneer heat source over the temperature range from 800 to 1000 C. Results obtained are strongly a function of the controlling oxygen transport mechanism. Author (NSA)

N71-28751# Bendix Corp., Kansas City, Mo.
[MECHANICAL PRODUCTS AND METAL WORKING DEVELOPMENTS] Quarterly Report
Feb. 1971 124 p refs
(Contract AT(29-1)-613)
(BDX-613-316) Avail: NTIS

A case is summarized in which the investment casting process was successfully applied as a production method, replacing a formed sheet-metal welded assembly. The casting approach not only improved the probability of insuring conformance with required design limitations, but also resulted in cost reduction. The development of a process to produce a deep-drawn stainless steel container to tolerances approaching those required of metal parts is outlined. A metal forming concept and a special shaped hydroforming diaphragm are detailed. Longitudinal and spiral milling of cable grooves in a long aluminum case by use of a Gisholt center drive lathe is reported. The ability of a metal and plastic switching pin to withstand an operational shock in excess of one million g's was significantly improved with a configuration change and by changing the insulating material from nylon to polycarbonate. Author

N71-28752# California Univ., Berkeley. Lawrence Radiation Lab.
STUDY OF NICKEL-TUNGSTEN ALLOY (Ni4W) WITH FIELD-ION-FIELD-EMISSION MICROSCOPY
Joaquin Lira-Olivares (M.S. Thesis) Dec. 1970 60 p refs
(Contract W-7405-eng-48)
(UCRL-20330) Avail: NTIS

The existence of dark bands is substantiated and the conditions necessary for their appearance in field ion microscope images clarified. Field ionization micrographs of Ni4W as quenched from 1300 C showed a dark zone pattern at 78 K that was similar to the patterns obtained for Ni and Ni4Mo. A less conspicuous pattern was observed in the beta phase of the same alloy at 4.2 K. The dark band pattern was explained using a topographic model including preferential field evaporation at dark band regions of the specimen due to a higher work function at these regions. The use of field emission microscopy in conjunction with field ion microscopy proved effective in making it possible to discard some of the previous hypotheses and in relating work function to dark band formation. Author (NSA)

N71-28781# Los Alamos Scientific Lab., N.Mex.
BRAZE JOINT STRENGTH (REMELT TEMPERATURE VERSUS VARIOUS STRESS LEVELS AND BEND TESTS)
Steven P. Koczan Jan. 1971 20 p refs
(Contract W-7405-eng-36)
(LA-4584) Avail: NTIS

A strength evaluation is given of the braze alloys used to assemble the various components of the linear accelerator under construction at the Los Alamos Scientific Laboratory. Author (NSA)

N71-28799# Atomic Energy Commission, Washington, D.C. Div. of Technical Information.
EFFECTS OF INITIAL HEAT TREATMENT ON THE MECHANICAL PROPERTIES OF HIGH NICKEL ALLOYS AFTER NEUTRON IRRADIATION
S. N. Votinov et al Feb. 1971 22 p Transl. into ENGLISH from Russian report
(AEC-tr-7188) Avail: NTIS

The effects of initial heat treatment on high temperature embrittlement after irradiation were investigated on nickel alloys. It was shown that the states characterized by continuous precipitate walls along the boundaries and by the presence of the gamma phase precipitates inside the grains embrittle to a great extent after irradiation. Author (NSA)

N71-28801# Oak Ridge National Lab., Tenn.
DISCRETE ELEMENT ANALYSIS OF THE CREEP OF STAINLESS STEEL TUBING FOR LMFBR APPLICATION
B. R. Dewey Mar. 1971 58 p refs
(Contract W-7405-eng-26)
(ORNL-TM-3294) Avail: NTIS

As a specialized form of finite element stress analysis, the discrete element method was developed for hollow cylindrical solids subjected to pressure and thermal loading. The solution allows arbitrary radial variation of mechanical properties and temperature. The solution is also used to compute elastic and inelastic stresses and displacements, and to predict time dependent deformation based on empirical creep laws. Particular attention is given to the analysis of stainless steel tubing typical of that used in the LMFBR, wherein the creep, stress relaxation, and stress rupture predictions are compared with experimental results. Author (NSA)

N71-28806 National Lending Library for Science and Technology, Boston Spa (England).
THE INFLUENCE OF STACKING FAULTS ON PHASE CONVERSIONS IN Fe-Cr-Ni ALLOYS DURING LOW TEMPERATURE DEFORMATION [VLIYANIE DEFEKTOV UPAKOVKI NA FAZOVYE PREVRASHCHENIYA V Fe-Cr-Ni SPLAVAKH PRI NIZKOTEMPERATURNOI DEFORMATSII]
V. Ya. Ilichev et al Jan. 1971 16 p refs Transl. into ENGLISH from Metallofizika (Kiev), v. 23, 1968 p 78-87
(NLL-RTS-6189) Avail: Natl. Lending Library, Boston Spa, Engl.: £1.40; 5 NLL photocopy coupons

Nickel content and stacking fault effects on martensitic formations in austenite were studied. Specimens were subjected to tensile and compressive deformation of cryogenic temperatures. It was found that increasing the nickel content of the alloys suppresses the martensitic formation and at a 20% nickel content the martensitic formation does not occur with any degree of deformation or lowering of temperature. Martensitic formation is dependent on the amount of deformation, and compressive deformation causes less conversion than tensile. The probability of stacking fault occurrence in specimens during compressive deformation was studied by X-ray diffraction. Stacking faults increase with decreasing amount of nickel and with increasing amount of deformation. N.E.N.

N71-28830 National Lending Library for Science and Technology, Boston Spa (England).
OBTAINING MAGNETIC ALLOYS WITH SPECIAL PROPERTIES BY ELECTROCHEMICAL METHOD. COMMUNICATION NO. 1
F. K. Andryushchenko et al 3 Nov. 1970 11 p refs Transl. into ENGLISH from Zh. Prikl. Khim. (Moscow), v. 43, no. 3, Mar. 1970 p 573-577 In ENGLISH and RUSSIAN
(NLL-LTI-748-645-(9022.401); LTI-737-8598) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The preparation of magnetic films by electrochemical methods of nickel alloy containing 80% nickel for use in electronic memory

devices was investigated. The experimental method of preparing the film from an electrolyte consisting of pyrophosphate salicylate complexes of nickel and iron is described. F.O.S.

N71-28832*# Translation Consultants, Ltd., Arlington, Va.
STUDY OF THE SHORT TERM CREEP OF THE OT-4 ALLOY IN HIGH SPEED AIR FLOWS UNDER AERODYNAMIC VIBRATIONS [ISSLEDOVANIYE KRATKOVREMENNOY POLZUCHESTI SPLAVA OT-4 V SKOROSTNYKH VOZDUSHNYKH POTOKAKH PRI NALICHII AERODINAMICHESKIKH KOLEBANIY]
I. N. Bogachev et al Washington NASA Jun. 1971 11 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Metally (Moscow), no. 5, Sep. Oct. 1970 p 137 142
(Contract NASw-2038)
(NASA-TT-F-13658) Avail: NTIS CSCL 11F

The equipment, and a technique for testing mechanical properties and the erosion resistance of metallic materials exposed to a high-speed air flow are described. Special attention is given to the role of vibrations induced in specimens under different test conditions. It is found that the short-term creep behavior of the OT-4 alloy is completely different from that in still air. A statistical analysis is made of random stress caused by aerodynamic vibrations under different test conditions. Some regularities in stress distribution are determined with flow rate, angle of attack, and temperature taken into consideration. It is concluded that the creep properties of the OT-4 alloy are much less affected by vibrations than by corrosion and erosion attributable to high-speed air flow. Author

N71-28891*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE EFFECT OF THERMOCOUPLE ATTACHMENT BY SPOTWELDING AND BY ADHESIVE BONDING ON FATIGUE BEHAVIOR OF Ti-13V-11Cr-3Al AND Ti-6Al-4V
L. A. Imig Washington Jul. 1971 26 p refs
(NASA-TM-X-2288; L-7575) Avail: NTIS CSCL 11F

An experimental investigation was conducted to evaluate the effect of spotwelded or adhesively bonded thermocouples on the fatigue behavior of two titanium alloys suitable for use in high-speed airplanes: Ti-13V-11Cr-3Al in sheet form and Ti-6Al-4V in plate form. The effects of the thermocouple attachments were evaluated by comparing the results of constant-amplitude fatigue tests of specimens with thermocouples with those for plain specimens. The fatigue strengths at 10 to the 7th power cycles of specimens with spotwelded thermocouples were between one-fifth and one-third of the fatigue strengths of plain specimens for all test conditions. Specimens with thermocouples attached by adhesive bonding had fatigue strength equal to that of plain specimens. Author

N71-28898# South Carolina Univ., Columbia. Coll. of Engineering.
POWDER METALLURGY COMPACTION Quarterly Progress Report, 1 Dec. 1970 - 28 Feb. 1971
E. G. Schwartz, Kenneth L. Wilson, James B. Hornsby, and Tsee-Bor Ni Feb. 1971 38 p refs
(Contract AT(38-1)-475)
(SRO-475-10) Avail: NTIS

The effectiveness of superimposed vibrating forces in reducing die wall friction during powdered metal compaction was investigated. Frequencies between 2500 and 6500 cpm with amplitudes equivalent to powder particle size accounted for an approximate 20% reduction in die wall friction. This reduction is shown in numerous graphs at applied stress vs. die wall friction. A measureable increase (5.82%) in compact density resulting from applied vibrations was observed when compacting at 78% theoretical density. Author

N71-28899# Battelle Memorial Inst., Columbus, Ohio.
ENGINEERING DATA ON NEW AND EMERGING STRUCTURAL MATERIALS Final Summary Report, Nov. 1968 - Sep. 1970
O. L. Deel and H. Mindlin Wright-Patterson AFB, Ohio AFML Oct. 1970 274 p refs
(Contract F33615-69-C-1115)
(AD-720278; AFML-TR-70-252) Avail: NTIS CSCL 11/6

The major objectives of the research program were to evaluate newly developed structural materials of potential Air Force weapons system interest and then to provide data sheet type presentations of engineering data. The effort covered in the report has concentrated on Beta 3 titanium sheet, AF2-IDA heat-resistant alloy bar, 3Al-8V-6Cr-4Mo-4Zr (Beta C) titanium alloy forging, 300M high-strength steel forging 7178-T76 aluminum alloy sheet, 7049-T73 aluminum alloy hand forging, 6Al-4V titanium alloy extrusions, 5621-S titanium alloy forging, 6Al-4V titanium alloy sheet, 7175-T736 aluminum alloy die forging, and MP35N high-strength bar. The mechanical properties investigated include tension, compression, sheer, bend, impact, fracture toughness, fatigue, creep and stress-rupture, and stress corrosion at appropriate temperatures. Author (GRA)

N71-28921# Cincinnati Univ., Ohio. Dept. of Materials Science and Metallurgical Engineering.
HIGH TEMPERATURE OXIDATION OF COLUMBIUM-10 at PERCENT CHROMIUM ALLOY
C. J. Rosa and G. C. Chen Feb. 1971 64 p refs
(Contract DAHC04-69-C-0016)
(AD-721321; AROD-T-429-E) Avail: NTIS CSCL 11/6

Oxidation kinetics of Cb-10 at.% Cr alloy were studied at 900, 1000 and 1100C under oxygen pressures from 100 to 760 torr. At 1000 and 1100C the oxidation kinetics are lower than for pure Cb and the improvement is attributed to modifying effects of Cr cations dissolved in alpha - Cb2O5. At 900C the oxidation rates of the alloy are higher when compared with pure Cb and the decrease in oxidation resistance is related to polymorphic transformation in Cb2O5 scale. Author (GRA)

N71-28922*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
QUENCHING OF VANCANCIES INTO MOLYBDENUM
H. H. Grimes and E. R. Gotsky 1971 7 p refs Proposed for presentation at Discussion Meeting on Defects in Refractory Metals, Mol, Belgium, 20-22 Sep. 1971
(NASA-TM-X-67868; E-6414) Avail: NTIS CSCL 11F

A systematic study is presented of the variables of quenching environment, rate, and impurity effects on molybdenum. Preliminary results on quenching into a helium II environment are given. The quenched-in resistance measured is discussed in terms of possible causes. The experimental parameters are extended to both higher and lower quench rates, and annealing studies are used to aid in the identification of the quenched-in species. J.M.

N71-28931 National Lending Library for Science and Technology, Boston Spa (England).
MECHANICAL PROPERTIES OF Ni-Cr ALLOYS
I. B. Malysheva et al 3 Nov. 1970 6 p refs Transl. into ENGLISH from Ukr. Khim. Zh. (Kiev), v. 14, no. 10, Oct. 1969 p 1719-1721 In ENGLISH and RUSSIAN
(NLL-LTI-746-639-(9022.401); LTI-734-4501) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Hardening of ordered alloys was studied for Ni-Cr alloys in the region of the stoichiometric composition Ni2Cr. Considerable strengthening of these alloys was observed in annealing at 500 C for long periods. The strengthening is associated with the process of ordering. The greatest strengthening is observed in the alloys with the composition close to stoichiometric ones. Author

N71-28932 National Lending Library for Science and Technology, Boston Spa (England).
SOME CHARACTERISTICS OF ATOMIC STRUCTURE

CHANGES OF QUASIBINARY ALLOYS Ni3Mn-Ni3Fe AND Ni3Mn-NiCo DURING PHASE TRANSFORMATIONS

V. M. Zhukova et al Sep. 1970) 8 p refs Transl. into ENGLISH from Ukr. Fiz. Zh. (Kiev), v. 14, no. 10, Oct. 1969 p 1680-1683 In ENGLISH and RUSSIAN

(NLL-LTI-746-638 -(9022.401); LTI-734-4495) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A conclusion is drawn on the presence of the closed Fermi surface in both disordered and ordered alloys of a quasi-binary section Ni3Mn-Ni3Fe on the basis of experimental data. It is shown that the minimum is observed on the density curve of electronic states of the ordered alloys in the region of their Fermi level locations. It is established that in the disordered alloys Ni3Mn, hole areas of Fermi surfaces contribute to the transfer phenomenon. The role of the areas is considerably reduced in alloying Ni3Mn with iron and cobalt in ordering. Author

N71-28971 Washington Univ., Seattle.

UNFAMILIAR OXIDATION STATE OF ZIRCONIUM AND THE EFFECT OF OXYGEN ACTIVITY ON THE STRUCTURE OF ZrO2

K. Manikantan Nair (Ph.D. Thesis) 1969 78 p

Avail: Univ. Microfilms Order No. 70-14775

The Zr - ZrO2 system was investigated between the temperature 700 C. and 1600 C. using controlled oxygen partial pressures. The system was approached from two directions, (1) starting with pure metal powder and oxidizing it in argon and oxygen mixtures and (2) starting with pure ZrO2 powder and reducing it in different mixtures of CO and CO2. Two lower valence oxides of zirconium were observed by x-ray powder diffraction analysis. One of them had a f.c.c. Zinc Blende (ZnS) type crystal structure with an a sub o equals 3.8956 A and ZrO composition is proposed. The second oxide, Zr3O, had a hexagonal closed packed crystal structure similar to that of zirconium metal, with oxygen atoms occupying one third interstitial positions in an ordered manner. The stability of this oxide was determined. Dissert. Abstr.

N71-28972*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

NICKEL BASE ALLOY Patent Application

John C. Freche and William J. Waters, inventor (to NASA) 9 p Filed 28 Aug. 1970

(NASA-Case-LEW-10874-1; US-Patent-Appl-SN-68024) Avail: NTIS CSCL 11F

Nickel base alloys which have superior strengths at elevated temperatures, high incipient melting points, high impact resistance, and are not subject to embrittlement upon long time exposure at intermediate temperatures are discussed. Nickel base alloys which achieve these properties using a low number of alloying constituents are presented. The alloys exhibit good strength characteristics at very high temperatures. By way of example, at 2200 F, the preferred alloy has an ultimate tensile strength of 20,000 psi which is about two to three times that of other conventional, highly-alloyed nickel base alloys. It is even higher than that of TD-nickel, a dispersion strengthened powdered metallurgy product. The alloys have excellent room temperature impact strength, both as-cast and after long time exposure at 1600 F. The room temperature impact strengths are substantially higher than those of other known nickel base alloys. The preferred alloy has an incipient melting temperature of 2375 F, which is 150-175 F higher than the incipient melting temperatures of the strongest, conventional, high-alloyed nickel base alloys available today. NASA

N71-29016# Oak Ridge National Lab., Tenn.

CORROSION IN POLYTHERMAL LOOP SYSTEMS. 1: MASS TRANSFER LIMITED BY SURFACE AND INTERFACE RESISTANCES AS COMPARED WITH SODIUM-INCONEL BEHAVIOR

R. B. Evans, III and Paul Nelson, Jr. Mar. 1971 42 p refs (Contract W-7405-eng-26) (ORNL-4575-Vol-1) Avail: NTIS

For pumped loops operating in the turbulent flow regime, it was demonstrated analytically that the time transient required to achieve steady-state mass-transfer conditions is relatively short compared with normal loop operating times. Based on a calculated film coefficient, the predicted transport of nickel from the hot zone was five times greater than that obtained from measurements of crystal deposits in cold zones. This and other considerations suggest that contributions of film resistances are only partially responsible for corrosion in polythermal loops containing liquid metals. In other words, a complete description of the corrosion process will require considerable modification of the mechanism discussed here. All results were derived from a simple partial differential equation which is first order with respect to time and position. The solution of the differential equation is found in closed form; accordingly, it can be readily manipulated to exhibit the transient and steady-state parts. The solution will accommodate a wide variety of assumed experimental conditions. Author (NSA)

N71-29137* Hughes Aircraft Co., Culver City, Calif.

FABRICATION OF CONTROLLED-POROSITY METALS Patent

Roger R. Turk, inventor (to NASA) Issued 26 Nov. 1968 7 p Filed 28 Apr. 1965 Cl. 264-111 Sponsored by NASA

(NASA-Case-XNP-04339; US-Patent-3,413,393; US-Patent-Appl-SN-451596) Avail: US Patent Office CSCL 11F

Compact metal bodies of predetermined controlled porosity are prepared from metal powders and an improved method of compacting same, sintering, machining and finishing to provide the desired porosity are reported.

Official Gazette of the U.S. Patent Office

N71-29150 National Lending Library for Science and Technology, Boston Spa (England).

PITTING CORROSION OF STAINLESS STEELS USED IN THE MANUFACTURE OF WEAK NITRIC ACID

A. N. Kuzyukov et al 1 Jan. 1971 6 p refs Transl. into ENGLISH from Khim. i Neft. Mashinostr. (Moscow), v. 2, 1970 p 22-23 In ENGLISH and RUSSIAN

(NLL-Windscale-Trans-435-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The tendency to pitting corrosion of stainless steels was investigated in water containing 2000 mg/l chlorine ions, 250 mg/l sulfate ions, and mixtures of the two at 80 C. The steels exhibited no pitting in water containing only chlorine or only sulfate ions. Pitting was observed in two of the three steels submerged for 500 hr in water containing both ions. It is recommended that the cooling system have water with low concentrations of the ions, or that the pipes be made of a steel with high resistance to both nitric acid and ion corrosion. N.E.N.

N71-29159 National Lending Library for Science and Technology, Boston Spa (England).

WORK HARDENING OF SINGLE CRYSTALS OF NICKEL BASED AGEING ALLOYS WITH ORDERED PHASE OF PRECIPITATION

G. I. Nosova et al 3 Nov. 1970 8 p ref Transl. into ENGLISH from Ukr. Fiz. Zh. (Kiev), v. 14, no. 10, Oct. 1969 p 1688-1691 In ENGLISH and RUSSIAN

(NLL-LTI-746-637-(9022.401); LTI-743-4496) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupons

The characteristics of aging nickel-aluminum alloys and Nimonic alloys on the work hardening at room temperature were investigated. The phase precipitating in these alloys as a result of decomposition of super saturated solid solutions with the face centered cubic lattice has the same structure, but has undergone hardening. The alloys were investigated after quenching and annealing of different durations at 750 degrees C for nickel-aluminum and 750 and 850 degrees C for Nimonic alloys. P.N.F.

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N71-28012*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

OXIDATION OF CARBON AT HIGH TEMPERATURES: REACTION-RATE CONTROL OR TRANSPORT CONTROL

Howard G. Maahs Washington Jun. 1971 22 p refs
(NASA-TN-D-6310; L-7696) Avail: NTIS CSCL 11D

In spite of a general acceptance in making predictions of ablation rate that the oxidation rate of carbon is limited at temperatures of about 1650 K or above by the rate of oxygen transport to the carbon surface, a large body of existing experimental data on the carbon-oxygen reaction indicates that this may not be so. Furthermore, these data indicate a distinct departure from simple Arrhenius behavior and even a maximum in the rate curve as a function of temperature. These data were analyzed and compared with theoretical maximum stagnation-point transport-limited rates; this comparison has shown that even at very high temperatures, in many situations the rate of chemical reaction is considerably below the theoretical maximum transport limited rate. Hence, the carbon-oxygen reaction may be chemically controlled in many situations at much higher temperatures than previously suspected. Author

N71-28035*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

THREE THOUSAND HOUR ELECTRICAL TEST OF AN ALUMINA TRILAYER AT 1325 K

John T. Mayer Washington Jun. 1971 15 p refs
(NASA-TM-X-2303; E-6139) Avail: NTIS CSCL 11D

A thermionic sheath insulator specimen, in the form of a bonded niobium/alumina/niobium cylindrical sandwich, was tested in vacuo with a continuous dc voltage applied, in order to examine possible electrolysis effects. The trilayer resistance remained relatively constant for the first 1000 hours. It then increased (over a period of about 500 hr) by a factor of 5 and remained at this value to the end of the test. Post-test examination revealed no major changes in the gross physical characteristics of the sample. However, some evidence of damage was seen in the photomicrographs. Author

N71-28132*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

EFFECTS OF A SIMULATED MARTIAN MISSION ON THE MECHANICAL PROPERTIES OF DACRON PARACHUTE MATERIAL

David C. Spence Washington Jun. 1971 40 p refs
(NASA-TN-D-6242; L-7486) Avail: NTIS CSCL 11D

The effects of a simulated Martian mission on the mechanical properties of 67.8-g/sq m Dacron Type 55 parachute material was determined by uniaxial tensile testing at a constant strain rate for four groups of samples. The first group was exposed to the mission environments of ethylene oxide decontamination, dry heat sterilization, vacuum, and a simulated Martian atmosphere and tensile tested in situ. The second group was a control group and was stored and tested at 24 C and 45 percent relative humidity. The third and fourth groups were exposed to selected mission environments. The results of this investigation indicate that the exposure of Dacron to these mission environments will induce changes to the mechanical properties of this material. The change in mechanical properties does not exceed 8 percent in maximum stress, 23 percent in elongation at maximum stress, 29 percent in total energy, 12 percent for initial modulus, and +9 percent for final modulus. Vacuum had the largest single effect on the mechanical properties of the parachute material. Author

N71-28133# Army Natick Labs., Mass.

THE THERMAL CONDUCTIVITY OF NATURAL RUBBER FROM 134 TO 314 K

Malcolm N. Pilsworth, Jr., Harold J. Hoge, and Henry E. Robinson Jan. 1971 37 p refs
(AD-721288; USA-NLABS-TR-71-33-PR) Avail: NTIS CSCL 11/10

The thermal conductivity of soft natural rubber, compounded and vulcanized as specified in ASTM recipe 2A, has been measured over a range extending from well below the glass transition to above room temperature. The glass-transition temperature deduced from the thermal-conductivity measurements is 212K (-78F). The thermal-conductivity data are believed to be accurate to 3% or better at room temperature and to about 6% at the glass transition and below. Author (GRA)

N71-28182# Alabama Univ., Huntsville. Dept. of Engineering and Mechanics.

ALTERNATE DEVELOPMENTS OF THE THERMOMECHANICAL EQUATIONS FOR THERMOVISCOELASTIC SOLIDS

Thomas L. Cost 11 Mar. 1971 44 p refs
(Contracts F44620-69-C-0124; DAAH01-69-C-0853; DAAH01-68-C-0891; Proj. Themis)
(AD-720290; AFOSR-71-0616-TR) Avail: NTIS CSCL 20/12

The constitutive equations required to analyze the behavior of thermorheologically simple materials in which thermomechanical coupling effects are of interest are derived from three different viewpoints. The theory of irreversible thermodynamics developed by Biot, the rational mechanics approach developed by Coleman, and a phenomenological model approach described by Staverman and Schwarzl are each used to obtain the energy equation, including the dissipation function, for thermoviscoelastic materials. Although the approaches are considerably different, the results are shown to be practically equivalent. Author (GRA)

N71-28285 National Lending Library for Science and Technology, Boston Spa (England).

INCREASE IN THE RIGIDITY OF FIBRES IN AN ELECTRIC FIELD [OB UVELICHENII ZHESTKOSTI VOLOKON V ELEKTRICHESKOM POLE]

B. N. Streltsov et al Dec. 1970 9 p refs Transl. into ENGLISH from Tekstil. Prom. (Moscow), no. 7, 1970 p 44-46
(NLL-RTS-5769) Avail: Natl. Lending Library, Boston Spa, Engl.: £0.70; 2 NLL photocopy coupons

The dynamics of free, discrete fibers moving under the combined action of electric and aerodynamic forces is studied for spindleless spinning. Mathematical expressions are developed for the motion of the fibers, the moment of inertia about the fastened end, the equivalent rigidity, and the magnitude of the charge on the fiber. Experiments on the determination of the charge by the resonance method are reported. It is concluded that the equivalent rigidity of a fiber in electric field parallel to its axis is greater than under normal conditions by approximately a power of ten. The equivalent rigidity increases with charge and in proportion to the strength of the parallel electric field. The field strength increase is accompanied by increases in charge on the fiber and in its resonance frequency. N.E.N.

N71-28324# Technische Hogeschool, Delft (Netherlands). Afdeling der Technische Natuurkunde.

THE DETACHMENT OF NON-PIGMENTED RESIN FILMS [DE ONTHECHTING VAN NIET GEPIGMENTEERDE HARSFILMS]

Joost De Jong (Ph.D. Thesis) 1970 97 p refs In DUTCH; ENGLISH summary
Avail: NTIS

The peeling-off of a blistered lacquer film is investigated. Depending on the adhesion and the viscosity of the film, the formation of blisters will vary. A model describing the film-peeling-off

is developed and experiments are carried out with alkyd resin films and glass as substrate. It is proved that for aluminum, stainless steel, brass, and perspex as substrates the equations are valid. Attention is also paid to the blistering of lacquer films on wood and combined blistering and corrosion on mild steel. ESRO

N71-28361# Technische Hogeschool, Delft (Netherlands). Afdeling der Technische Natuurkunde.

DIP-COATING BY WITHDRAWAL OF LIQUID FILMS

Pieter Groenveld (Ph.D. Thesis) 1970 119 p refs

Avail: NTIS

The thickness of the liquid layer remaining on objects such as flat plates wires, and tubes removed from a liquid bath was determined in the intermediate region where the liquid film reduces in thickness from the diameter of the pool of liquid from which it was formed to the constant thickness film on the object, further away from the pool. ESRO

N71-28468# Weber State Coll., Ogden, Utah. Chemistry Dept.

USING ACCELERATED HYDROLYTIC REVERSION DATA TO PREDICT SERVICE LIFE OF ELASTOMERIC POTTING COMPOUNDS Final Summary Report, 15 Feb. 1969 - 28 Feb. 1970

Garth L. Welch and Louis R. Lofgreen Feb. 1971 33 p refs

(Contract F33615-67-C-1559)

(AD-721676; AFML-TR-70-297) Avail: NTIS CSCL 11/10

A method is proposed for estimating the service life of two specific potting compounds based upon reversion data obtained at high temperatures and various humidities at each temperature. Reversion was followed using the change in durometer hardness with time. This method separates the effect of the water vapor concentration from the effects of the temperature on the rate of reversion. Knowing the vapor pressure of water at each temperature, and using the Arrhenius equation to extrapolate the data obtained, a reversion time can be calculated for any desired combinations of temperature and relative humidity, including cyclic operating conditions where temperature and humidity follow a regular cycle. Author (GRA)

N71-28469# Army Edgewood Arsenal, Md. Industrial Operations Div.

COMBINED STUDY OF ELECTROMAGNETIC PULSE FORMING FOR CHEMICAL AND ORDNANCE MUNITION WORK Technical Report, May 1967 - Sep. 1969

Francis B. Gurtner Feb. 1971 86 p refs

(AD-722234; EA-TR-4437) Avail: NTIS CSCL 13/8

In the Electromagnetic pulse forming (EMPF) program, several points of interest were investigated. Among these were the following: Behavior of photoelastic coatings in the presence of rapidly changing magnetic fields; Change in properties of adhesives and reflective coatings in magnetic fields; Technique of photoelastic measurement during the high transitory rate of the changing field; Correlation of data between strain gauges and photoelastic measurement in changing magnetic fields; and Technique of recording the measurements. Author (GRA)

N71-28474# Mechanical Technology, Inc., Latham, N.Y.

SUBSTRATE CORROSION OF PLASMA COATED SURFACES

Salvadore J. Calabrese and Coda H. T. Pan Feb. 1971 21 p refs

(Contract N00014-71-C-0074)

(AD-722006; MTI-71TR7) Avail: NTIS CSCL 13/8

To use a hard coating surface in a chemically active environment such as steam-lubricated bearings, it is important to prevent substrate corrosion. It is believed that coating porosity permitting entrapment of the condensate (water) may be responsible for the initiation of corrosion in a substrate containing chrome and carbides. This phenomenon was experienced on a shaft in storage several months after it was used in tests. A small scale investigation consisting of controlled experimentation on twelve hard coating specimens substantiated this explanation. The same investigation also showed that the use of a non-corrosive, non-porous undercoat which has an adequate bonding strength with both the substrate and the hard coating is effective in suppressing the problem. Author (GRA)

N71-28475# Picatinny Arsenal, Dover, N.J.

PREDICTION OF FAILURE TIMES OF ADHESIVE BONDS AT CONSTANT STRESS. 2. FAILURE AT LOW HUMIDITY

Elise Mc Abee and David W. Levi Dec. 1970 28 p refs

(AD-722251; PA-TM-1978) Avail: NTIS CSCL 13/5

Two new procedures for estimating kinetic parameters from constant stress mechanical data are described. These procedures were applied to data on adhesive bonds obtained earlier. It was found that even for bonds tested at 20% humidity, consistent and reasonable results were obtained. By the previously used procedures, this correlation had been very doubtful. Author (GRA)

N71-28501*# IIT Research Inst., Chicago, Ill.

INVESTIGATION OF REFRACTORY COMPOSITES FOR LIQUID ROCKET ENGINES Final Report, 1 Oct. 1969 - 31 Oct. 1970

V. L. Hill and M. J. Malatesta 30 Nov. 1970 134 p refs

(Contract NAS7-758)

(NASA-CR-119019; IITRI-B6102-13) Avail: NTIS CSCL 11D

Potential composite systems were identified and evaluated for use in exhaust atmospheres containing fluorine-oxygen in liquid rocket engines. The basis for selection of materials for composites was a minimum melting point of 4000 F, oxidation-corrosion resistance in fluorine-oxygen, high-temperature stability, and fabricability. Iridium and iridium-rich alloys were the most oxidation-corrosion resistant in fluorine-oxygen atmospheres. Oxidation-corrosion studies were conducted on W-Re-Ir, Re-Ir, TaIr3 and HfIr3 in fluorine, oxygen, hydrogen fluoride, and their combinations, at 3000 to 4500 F. Tests were also conducted on those materials as well as tungsten and ATJ graphite in boron-containing atmospheres. Re-Ir and iridium intermetallics had good oxidation-corrosion resistance in fluorine-oxygen, but exhibited surface melting in boron-containing atmospheres at 3000 to 4000 F. W-Re-Ir alloys had higher surface recession rates than iridium-rich systems. A discussion of oxidation-corrosion mechanisms is included. Author

N71-28506# Naval Civil Engineering Lab., Port Hueneme, Calif.

USE OF X-RAY DIFFRACTION AND INFRARED SPECTROSCOPY IN PAINT ANALYSIS Final Technical Report, Jul. 1969 - Jun. 1970

R. W. Drisko and J. B. Crilly Mar. 1971 26 p refs

(AD-721696; NCEL-TN-1143) Avail: NTIS CSCL 11/3

A method was developed for distinguishing among the exterior oil paints TT-P-102, Class A; TT-P-102, Class B; TT-P-103; TT-P-104; and TT-P-105 by X-ray diffraction. Methods utilizing X-ray diffraction were also developed for quantative analyses of (1) zinc and zinc oxide in mixtures of these two pigments and (2) asbestos in a paint pigment. Infrared spectra of forty weathered exterior paints were prepared using potassium bromide disks without separation of the paint pigment and vehicle. Many different generic types of paint were found to have characteristic absorption bands that permit their identification. Author (GRA)

N71-28551# California Inst. of Tech., Pasadena. Div. of Engineering and Applied Science.

LOAD ABSORPTION BY A DISCONTINUOUS FILAMENT IN A FIBER REINFORCED COMPOSITE

Rokuro Muki and Eli Sternberg Mar. 1971 30 p refs

(Contract N00014-67-A-0094-0020)

(AD-721999; TR-23) Avail: NTIS CSCL 20/11

The investigation deals analytically with the static load-absorption by a single elastic fiber consisting of two disjoint but contiguous semi-infinite segments, which are fully immersed in, and continuously bonded to, an all-around infinite elastic matrix of distinct mechanical properties. At infinity the matrix is assumed to be in a state of uniform uni-axial tension parallel to the axis of the embedded fiber. An approximate scheme-tested earlier in connection with a more elementary three-dimensional load-transfer problem and applied previously to a related simpler problem in the theory of fiber-reinforced materials-is modified and adapted to the present circumstances. This scheme results in a characterization of the desired filament force through an integral equation of Fredholms second kind, which is treated by numerical means. Quantitative results, showing the distribution of the filament force for various values of the governing stiffness-ratio, are presented.
Author (GRA)

N71-28583# Princeton Univ., N.Y. Dept. of Aerospace and Mechanical Sciences.
AN EXPERIMENTAL STUDY OF THE HEAT GENERATED DURING CYCLIC DEFORMATIONS OF GLASS-EPOXY COMPOSITES
Genevieve Segol and T. R. Tauchert Dec. 1970 116 p refs
(Contract DAHC04-69-C-0062)
(AD-721322; AMS-932-T; AROD-8090.4-E; TR-21) Avail: NTIS CSCL 11/9

Data are presented which show the effect of frequency and strain amplitude on glass-fiber reinforced plastic specimens subjected to torsional oscillations. The first part of this work is concerned with hysteresis loops recorded at frequencies of 120 cpm, and 300 cpm and angles of twist equal to 10 degrees, 15 degrees, and 20 degrees. Data corresponding to various ambient temperatures were also obtained. The second part deals with steady-state experiments, in which the specimen was oscillated until the surface temperature reached a steady-state value. The temperature and stress histories were recorded simultaneously.
Author (GRA)

N71-28615# Naval Ordnance Lab., White Oak, Md.
SURFACE-COMPRESSION STRENGTHENED GLASSES: SOME PROPERTIES
Henry A. Perry 17 Mar. 1971 85 p refs
(AD-721327; NOLTR-71-21) Avail: NTIS CSCL 11/2

Some properties of the surface-compression strengthened (SCS) glasses are reviewed including strength, stiffness, density, thermal properties, electrical properties, environmental resistances and parametric standings among materials. Their properties are such that they can now be used in critical components and structures. Tests indicate that those parts of weapons, structures and systems which are made of SCS glass can survive three years, and probably more than ten years, between refurbishment opportunities, and suffer no greater than ten percent deterioration. Their low densities and adequate mechanical properties permit their use in lightweight structures and components. They combine strength with optical transmissivity. Data are missing or inadequate on some high-strength types and on some properties in general. Existing data are sufficient to suggest many advantageous naval uses - mechanical, structural, electrical, optical - which should be explored.
Author (GRA)

N71-28630# Alabama Univ., Huntsville. Dept. of Engineering and Mechanics.
A FREE ENERGY FUNCTIONAL FOR THERMORHEOLOGICALLY SIMPLE MATERIALS
Thomas L. Cost 11 Mar. 1971 30 p refs
(Contracts F44620-69-C-0124; DAAH01-69-C-0853; DAAH01-68-C-0891; Proj. Themis)
(AD-720291; AFOSR-71-0615TR) Avail: NTIS CSCL 20/12

A systematic procedure developed by Coleman for establishing thermodynamically consistent constitutive equations is used to develop the thermomechanical constitutive equations for thermorheologically simple viscoelastic materials. The usefulness of the procedure is demonstrated and the exact form of the equations discussed and compared with results obtained by considering phenomenological models. Results from both approaches are shown to be essentially equivalent.
Author (GRA)

N71-28649# Aerospace Corp., El Segundo, Calif. Lab Operations.
THERMAL-SHOCK-RESISTANT MATERIALS Technical Report, Jul. 1961 Jun. 1970
Ronald C. Rossi Feb 1971 41 p refs
(Contract F04701-70-C-0059)
(AD-721667; TR-0059(6250-40)-6; SAMSO-TR-71-64) Avail: NTIS CSCL 11/4

Aerospace applications that take advantage of the refractory nature of ceramic materials also impose upon these materials severe conditions of thermal shock. The severity of this thermal environment is so great that prevention of crack nucleation is not possible. Therefore, thermal-shock-resistant materials for severe environments are designed to prevent crack propagation. These materials can sustain thermal strains without generating the thermal stresses that otherwise would lead to catastrophic failure. The thermal-shock-resistant materials that have been developed are composite materials with either carbide or oxide matrices. Thermal simulation tests have revealed that these materials have resistances to thermal shock far superior to those of more conventional ceramic materials. The ability to withstand such severe thermal conditions can be attributed to the behavior of the individual phases within the microstructures.
Author (GRA)

N71-28683# United Kingdom Atomic Energy Authority, Culcheth (England).
DESORPTION STUDIES ON NUCLEAR GRAPHITE
B. W. Ashton, V. Y. Labaton, and A. Smith (Surrey Univ.) May 1970 19 p refs Presented at the 3d Intern. Conf. on Ind. Carbon and Graphite, London, 14 – 17 Apr. 1970
(TRG-2010; CONF-700407-2) Avail: AEC Depository Libraries

The gases desorbed from three nuclear graphites in the asreceived state and after irradiation in CO/CH4/CO2 coolants were identified and measured. The results were examined in terms of the effects of graphite type, and the importance of surface complexes in inhibition of the radiolytic graphite/CO2 reaction.
Author (NSA)

N71-28729* General Electric Co., Pleasanton, Calif.
METHOD OF MAKING A CERMET Patent
Alexis I. Kaznoff and Mickey O. Marlow, inventors (to NASA) Issued 18 May 1971 2 p. Filed 20 Dec. 1968 Cl. 148-126; Int. Cl. C21d1/00 Sponsored by NASA
(NASA-Case-LEW-10219-1; US-Patent-3,579,390; US-Patent-Appl-SN-785780) Avail: US Patent Office CSCL 11B

A cermet for nuclear fuel is constructed by pressing metal coated ceramic particles in a die at a temperature sufficient to cause bonding of the metal coatings to one another. The cermet is then heat treated to mechanically uncouple the ceramic particles from the metal matrix whereby expansion of the cermet when heated is substantially the same as that of the metal matrix. This satisfied the requirement that a cladding material have a thermal coefficient of expansion the same as that of the cermet matrix material. The cladding is therefore not subjected to disruptive stresses and the cermet is dimensionally stable when subjected to thermal cycling.
Official Gazette of the U.S. Patent Office

N71-28734# Central Lab. TNO, Delft (Netherlands).
CALCULATION OF ELASTIC PROPERTIES OF COMPOSITES BY MEANS OF THE VAN der POEL THEORY
Friedrich R. Schwarzl and Johannes van der Elkhoff Feb. 1971 51 p
(Contract F61052-67-C-0059)
(AD-721376; CI-71/55; TR-9) Avail: NTIS CSCL 21/9

A theoretical model for the calculation of shear modulus, bulk modulus and thermal expansion behaviour of two phase composite materials due to Van der Poel is analysed and the calculations are generalized for arbitrary elastic constants of the constituents. Results are presented in explicite form and a computer program for the performance of t e necessary calculations is included. Results for the shear moduli of the composite materials are discussed and compared with meesurements on the composite system polyurethane rubber-sodium chloride. Author (GRA)

N71-28975 National Lending Library for Science and Technology, Boston Spa (England).
ZIRCONIUM-CONTAINING GLASSES WITH INCREASED CHEMICAL AND THERMAL STABILITY [TSIRKONIISODERZHASHCHIE STEKLA S POVYSHENNOI KHIMICHESKOI I TERMICHESKOI USTOICHIVOSTYU]
O. K. Botvinkin et al 8 Apr. 1970 6 p refs Transl. into ENGLISH from Steklo, Inform Byul. Vses. Nauchn.-Issled. Inst. Stekla (Moscow), no. 2, 1967 p 20–23
(NLL-Lib-Comm-1518-(5196)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The production of a zirconium-containing glass with improved chemical and thermal stability is reported. Based on the refractory system Na_2O-ZrO_2-SiO_2, glass was developed to meet the physical and chemical property requirements for elements involved in the thread producing process. Performance tests confirmed the reliability of the material in the following areas: (1) chemical resistance in relation to acid media; (2) low thermal expansion coefficient; and (3) microhardness and capacity to withstand the mechanical effect of viscose thread. In addition, the use of zirconium dioxide as a constituent facilitated conformity in the crystal structure of the synthesized material. A.C.R.

N71-28998 Pennsylvania State Univ., University Park.
EFFECT OF SINTERING AND GRAIN GROWTH REACTIONS ON THE DISTRIBUTION OF NIOBIUM ADDITIVES IN BARIUM TITANATE CERAMICS
Manfred Kahn (Ph.D. Thesis) 1969 209 p
Avail: Univ. Microfilms Order No. 70-13838

Barium titanate powders were coated by a hydrolysis process with up to 5.6 wt. percent of Nb_2O_5. The degree of grain growth that occurred during subsequent sintering was found to have bearing on the frequency and temperature dependencies of the dielectric properties. Grain growth control made it possible to obtain dielectric constant-temperature curves that corresponded to two different sets of results shown in the literature and also had a significant bearing on the lattice parameters and on the shapes of reflections observed during X-ray diffraction. It was concluded that a homogeneous solid solution of niobium in barium titanate was obtained only after appreciable grain growth and recrystallization had taken place. X-ray diffraction of pure, grain growth-inhibited barium itanate indicated that it undergoes a sintering process similar to niobium doped material, and that lattice strains, or low angle grain boundaries are retained in the grain cores during sintering. Dissert. Abstr.

N71-28999 Iowa State Univ., of Science and Technology, Ames.
SELECTED PROPERTIES OF SODIUM SILICATE GLASSES AND THEIR STRUCTURAL SIGNIFICANCE
William Edward Martinsen (Ph.D. Thesis) 1969 84 p
Avail: Univ. Microfilms Order No. 70-13609

The structure of sodium silicate glasses was investigated by determining certain properties of the glasses. Electron micrographs were made of etched fracture surfaces of the glasses to study the extent and nature of the immiscibility region. Infrared transmission minima and the glass structure is discussed. The density and index of refraction are presented. The electrical conductivity of each sample was determined before and after melting under vacuum. The general shape of the property versus composition curves is discussed, and the effects of the vacuum melting are considered. The electrical conduction process is also discussed. Activation energies for electrical conduction are presented and the shape of the activation energy versus composition curve is discussed in regard to its structural implications. Dissert. Abstr.

N71-29012 National Lending Library for Science and Technology, Boston Spa (England).
DETERMINING THE MOBILITY OF POWDERED MATERIALS AND ITS DEPENDENCE ON SURFACTIVE AGENTS AND PARTICLE SIZE [OPREDELENIE POPVIZHNOSTI POROSHKOOBRAZNYKH MATERIALOV I EE ZAVISIMOST OT DOBAVOK POVERKHNOSTNO-AKTIVINYKH BESHCHESTV I KRUPNOSTI]
V. V. Tovarov et al Jan. 1971 12 p refs Transl. into ENGLISH from Tr. Gos. Vses. Nauchn.-Issled. Inst. Tsementn. Prom. (Moscow), v. 34, 1969 p 97–105
(NLL-RTS-6267) Avail: Natl. Lending Library, Boston Spa, Engl.: £1.10; 4 NLL photocopy coupons

The mobility of powders resulting from milling, which fill the cavities between the grinding bodies, is investigated and the effects of fineness and surfactants are studied. A method was developed for determining and evaluating the mobility of powders by simulating the operation of tube mills. Addition of several surfactants was found to reduce or increase the mobility of the powder by 4 to 7 times. N.E.N.

N71-29040* International Harvester Co., San Diego, Calif.
SILICIDE COATINGS FOR REFRACTORY METALS Patent
Ray T. Wimber, Alvin R. Stetson, and Arthur G. Metcalfe, inventors (to NASA) Issued 6 Apr. 1971 3 p Filed 8 Aug. 1968 Cl. 148-6; Int. Cl. C23c9/00, 11/06 Sponsored by NASA
(NASA-Case:XLE-10910; US-Patent-3,573,996; US-Patent-Appl-SN-751061) Avail: US Patent Office CSCL 11C

A silicide coating process in which a modifier alloy is slurry applied and vacuum sintered onto a substrate preparatory to siliciding is described. Official Gazette of the U.S. Patent Office

N71-29142 National Lending Library for Science and Technology, Boston Spa (England).
APPARATUS FOR DETERMINING THE REACTIVITY OF GRAPHITE MATERIALS
M. E. Semenov et al 12 Oct. 1970 6 p refs Transl. into ENGLISH from Zavodsk. Lab. (Moscow), no. 5, 1970 p 621–623
(NLL-RISLEY-Trans-2012-(9091.9F) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Equipment has been developed which allows the study of the reactivity of graphite materials in conditions which are as nearly as possible isothermal, at temperatures from 1200 to 3000 C. The apparatus consists of three systems: for heating the sample; dosage and heating of the gas; and determining the temperature of the gas and the sample. The component parts and their operation are described and discussed. The reactivity of the graphite materials is evaluated according to values of the velocity constant of the chemical reaction. A.L.

N71-29160 National Lending Library for Science and Technology, Boston Spa (England).
EFFECT OF PRESSURE ON THE STRUCTURE OF GRAPHITE MATERIALS DURING INTENSIVE WEAR
L. A. Plutalova et al 23 Sep. 1970 12 p refs Transl. into ENGLISH from Fiz.-Khim. Mekhan. Materialov, Akad. Nauk Ukr. SSr (Kiev), v. 6, 1970 p 49–54 In ENGLISH and RUSSIAN
(NLL-RISLEY-Trans-1990-(9091.9F)) Avail. Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The structure of intensive wear products of graphite formed in air was investigated using a diffractometer in graphitized, semigraphitized, and calcined rods. It was found that the most severe structural deformation was observed at pressures close to the critical value, and the wear products contain about 10% crystalline phase, 40% turbostrates, and 50% amorphous carbon. F.O.S.

N71-29174 National Academy of Sciences – National Research Council, Washington, D.C. Committee on Coatings.
HIGH TEMPERATURE OXIDATION RESISTANT COATINGS: COATINGS FOR PROTECTION FROM OXIDATION OF SUPERALLOYS, REFRACTORY METALS, AND GRAPHITE
1970 230 p refs
Avail: Printing and Publishing Office, NAS-NRC, 2101 Constitution Ave., Washington, D.C. 20418; $12.50

The current generation of coating systems is not adequate for the advanced applications that are predicted to evolve within the next five to fifteen years. Major advances will be required in oxidation behavior, microstructural stability, manufacturing technology, and overall system reliability. The prospect of developing adequate systems is not favorable, and a reappraisal of design concepts and performance requirements is therefore indicated. There is a dearth of sound approaches to the development of new or improved coating systems. A fundamental understanding of the factors that govern the performance of existing coatings is needed to provide a sound basis for developing of advanced coating systems. Specific conclusions related to general areas of application are given for: (1) gas turbines; (2) chemical propulsion; (3) hypersonic vehicles; (4) energy conversion systems; and (5) industrial applications. Author

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

N71-28001*# Texas A&M Univ., College Station. Inst. of Statistics.
MULTINOMIAL SELECTION INDEX
W. B. Smith and D. M. Scott Apr. 1971 14 p refs
(Grant NGR-44-001-097)
(NASA-CR-115060; TR-5) Avail: NTIS CSCL 12A

The linear selection index is considered assuming both full and partial records are available and that the phenotypic vectors follow a multinomial distribution. An estimation procedure is discussed and certain simulation studies are presented to support the claimed optimality properties. The S-P multivariate normal technique is applied to multinomial data for comparison with the multinomial estimation procedure. Author

N71-28002*# Texas A&M Univ., College Station. Inst. of Statistics.
AN EXAMPLE OF AGE DEPENDENCY IN COMPARTMENTAL ANALYSIS
J. H. Matis Mar. 1971 19 p refs
(Grant NGR-44-001-097)
(NASA-CR-115061; TR-6) Avail: NTIS CSCL 12A

Compartmental analysis is proposed for dividing many biological systems into compartments through which materials are transferred; the steady state provision specifies that this transfer process is characterized by linear kinetics. The rate of flow between any two compartments is described by an unknown transfer rate coefficient which according to linear kinetics is constant over time. These coefficients combine into a sums of exponentials function which then describe passage through the whole system. Data fitted to the sums of exponentials function estimate the rate parameters of a compartmental model. A compact analytic solution to the distribution theory of a particular nonsteady state model is presented. The application of the solution is illustrated with biological data. Author

N71-28036 National Lending Library for Science and Technology, Boston Spa (England).
SOME PROPERTIES OF HOMEOMORPHISMS OF CONSTRUCTIVE METRIC SPACES [NEKOTORYE SVOISTVA GOMEOMORFISMOV KONSTRUKTIVNYKH METRICHESKIKH PROSTRANSTV]
V. P. Orevkov Oct. 1970 8 p refs Transl. into ENGLISH from Zap. Nauchn. Seminarov Leningrad Mat. Inst. im Steklova Akad. Nauk SSSR (USSR), v. 16, 1969 p 157 – 164
(NLL-RTS-5861) Avail: Natl. Lending Library, Boston Spa, Engl.: 14 s; 2 NLL photocopy coupons

The topological invariance of the dimensionality of constructive triangulatable spaces is considered and a constructive analogue of Brouwer's theorem on invariant areas is given. Author

N71-28078*# Virginia Polytechnic Inst., Blacksburg. Dept. of Engineering Mechanics.
TWO STOCHASTIC MODELS FOR SIMULATION OF CORRELATED RANDOM PROCESSES
M. Hoshiya and H. W. Tieleman Jun. 1971 48 p refs
(Grant NGL-47-004-067)
(NASA-CR-118990; VPI-E-71-9) Avail: NTIS CSCL 12A

Two methods are described to simulate a set of two correlated stationary and Gaussian processes with zero mean. The first method utilizes an exponential model with a uniformly distributed phase angle. The second method utilizes a trigonometric model with randomly varying amplitudes with Gaussian probability density functions. In both cases the simulation can be achieved on the basis of known power spectral density functions of each of the random processes and their cross-spectral density functions. The random variables in the expressions describing the random process are generated with the use of established Monte Carlo techniques. The two methods are used for the simulation of two correlated stream wise turbulence components in the surface layer of the atmospheric boundary layer. These two turbulence components are taken at two different points A and B such that the separation distance A B lies in the horizontal plane normal to the direction of the mean wind. Autocorrelation functions, spectra, cross correlation functions, cross-spectral density functions and coherence functions are calculated numerically for each of the two sets of generated time histories and compared with the original spectrum functions and coherence function from which these time histories were generated. Author

N71-28100*# Brown Univ., Providence, R.I. Div. of Applied Mathematics.
AN OPTIMUM SETTLING PROBLEM FOR TIME LAG SYSTEMS
Marc Q. Jacobs and Ti-Jeun Kao [1970] 40 p refs
(Grants NGL-40-002-015; AF-AFOSR-693-67D)
(NASA-CR-118999) Avail: NTIS CSCL 12A

A linear control system is given. Starting from a given initial function at a certain time, the problem is to bring the system to rest at a specified time in such a way that a certain performance index is minimized on a class of admissible controls. The rest position or equilibrium psotion is in this case the zero function. In this notation the boundary conditions for the problem are contained in a solution to this type of problem by the classical method of Lagrange multipliers in a Banach space. Author

N71-28102*# Texas Univ., Austin. Applied Mechanics Research Lab.
A NONITERATIVE METHOD OF OBTAINING TCHEBYCHEFF RATIONAL APPROXIMATIONS

Hamilton Hagar, Jr. Jul. 1970 93 p refs
(Grant NGL-44-012-008)
(NASA-CR-119008; AMRL-1030) Avail: NTIS CSCL 12A

A simple method of obtaining rational forms as approximations to functions which may be expressed as power series is developed. The method is near-optimal under the Tchebychaff norm. While most approaches are iterative in nature, this method is free of this characteristic. The technique is developed as a combination of Pade rational approximation and Lanczos Tau method, which uses Tchebychaff polynomial properties for improving accuracy. In addition to some simple nonlinear functions, some examples from the field of astrodynamics are used to illustrate the method. Author

N71-28103*# Georgia Inst. of Tech., Atlanta. Rich Electronic Computer Center.

USE OF GREEN'S FUNCTIONS IN THE NUMERICAL SOLUTION OF TWO-POINT BOUNDARY VALUE PROBLEMS Final Report, 1 Apr. 1970 - 31 Mar. 1971

L. J. Gallaher and I. E. Perlin 31 Mar. 1971 66 p refs
(Grant NGR-11-002-101)
(NASA-CR-118993) Avail: NTIS CSCL 12A

The role of the Green's function in solving both linear and nonlinear second order ordinary differential equations with boundary conditions and systems of such equations, as well as procedures for numerical construction of Green's functions and conditions for their existence are investigated. Finally, there is a description of some numerical experiments using nonlinear problems for which the known existence, uniqueness or convergence theorems do not apply. Examples here include some problems in finding rendezvous and periodic orbits of the restricted three body system. Author

N71-28134*# Techtran Corp., Glen Burnie, Md.

AN EASY METHOD TO SOLVE NUMERICALLY THE EQUATIONS OCCURRING IN THE THEORY OF THE SECULAR PERTURBATIONS [UBER EIN LEICHTES VERFAHREN DIE IN DER THEORIE DER SAECULARSTOERUNGEN VORKOMMENDEN GLEICHUNGEN NUMERISCH AUFZULOESEN]

C. G. J. Jacobi Washington NASA Jun. 1971 50 p Transl. into ENGLISH from Z. fuer Reine unde Angew. Math., v. 30, 1846 p 51-95
(Contract NASw-2037)
(NASA-TT-F-13666) Avail: NTIS CSCL 12A

The theory of secular perturbations and small oscillations incorporates a system of linear equations in which the coefficients of the various unknowns in relation to the diagonal line are symmetrical, the wholly constant terms are missing, and the same entity $-x$ is added to all the coefficients present in the diagonal. By the elimination of the unknowns from such linear equations a conditional equation which must satisfy x is obtained. Algebraic expressions valid for the equations of such a system are deduced and a very convenient method for the calculation is reported. Author

N71-28135*# McMaster Univ., Hamilton (Ontario). Dept. of Psychology.

DISCRIMINATION OF BRIEF EMPTY TIME INTERVALS

Ramona Carbotte and A. B. Kristofferson Mar. 1971 82 p
(Grants NGR-52-059-001; NRC APA-112)
(NASA-CR-118996; TR-21) Avail: NTIS CSCL 12A

Experimental tests of three quantitative models of psychological time are presented. In two of these, psychological time is a continuous variable, and a statistical decision theory analysis is used to obtain predicted performance measures. The third is a finite state model. It assumes that there is a fixed time base underlying the measurement (coding) process, independent of sensory input. A measure of an interval is the number of time points occurring within it. When asked to choose the longer of a pair of intervals, the observer is in a state of uncertainty when the coding of the two intervals have the same value. In this case, it is assumed that the stimulus pattern has been stored and can be recoded a second time. The first experiment involved forced choice discrimination of adjacent intervals, defined by a pattern of three brief auditory signals, with a base duration of 156 ms. The second also involved adjacent intervals, but the observers made same-different judgments. In the third, the intervals were separated by two seconds; discrimination functions were obtained for two base durations (100 and 200 ms), using a forced choice procedure. The continuous models are shown to be inadequate, while the counting model accounts for the results of the three experiments reasonably well. Estimates of the period of the time base are of the order of 25, 50 and 100 ms. Author

N71-28152*# Brown Univ., Providence, R.I. Center for Dynamical Systems.

APPLICATIONS OF ALTERNATIVE SYSTEMS

Jack K. Hale May 1971 71 p refs
(Grants NGL-40-002-015; AF-AFOSR-0693-67D; DA-31-124-ARO-(D)-270)
(NASA-CR-119007) Avail: NTIS CSCL 12A

A general approach to the solution of functional equations is presented, and the way in which the appropriate functional equation may be obtained for a variety of applications is indicated. Approximate and periodic solutions are developed for the equation $Ax = Nx$, where A is a linear operator defined on some subspace of a Banach space and N is a linear or nonlinear operator. It is shown how this type of equation arises in the theory of bifurcation in integral equations, partial differential equations, and ordinary differential equations, and the theory of boundary value problems and asymptotics. Classical results on the existence of analytic solutions of linear differential systems with or without singular points are also obtained. Some particular problems in partial differential equations are discussed. N.E.N.

N71-28153# Joint Publications Research Service, Washington, D.C.

STRATEGIES AND AFTEREFFECTS IN DIFFERENTIAL GAMES

8 Jun. 1971 15 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 196, no. 2, 1971 p 278-281, and no. 4, 1971 p 779-782
(JPRS-53310) Avail: NTIS

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1. EXTREMAL STRATEGIES IN DIFFERENTIAL GAMES N. N. Krasovskiy et al p 1-7 refs (See N71-28154 16-19)

2. DIFFERENTIAL GAMES OF SYSTEMS WITH AFTEREFFECTS Y. S. Osipov et al p 8-14 refs (See N71-28155 16-19)

N71-28154# Joint Publications Research Service, Washington, D.C.

EXTREMAL STRATEGIES IN DIFFERENTIAL GAMES

N. N. Krasovskiy et al *In its* Strategies and Aftereffects in Differential Games 8 Jun. 1971 p 1-7 refs (See N71-28153 16-19)
Avail: NTIS

Theorems are proved concerning games with approximational mixed strategies and with specified conditions. The discussion is based on the system described by the equation $dx/dt = f(t,x,u,v)$, where x is the n-dimensional phase vector, u and v are vectorial controlling moves for the first and second players confined by restrictions involving compact sets, and the continuous function $F(t,x,u,v)$ in each confined region satisfies the Lipschitz condition with respect to x and the conditions for the extensibility of the solutions $x/t/$. The first player tries to shift a point in a closed set, and the second player tries to block him. It is assumed that at each current time instant the players know the position of the game that has been realized, but they do not know the choice of control by the partner in the given instant and in subsequent time instants. Author

N71-28155# Joint Publications Research Service, Washington, D.C.
DIFFERENTIAL GAMES OF SYSTEMS WITH AFTEREFFECTS
Yu. S. Osipov et al *In its* Strategies and Aftereffects in Differential Games 8 Jun. 1971 p 8 - 14 refs (See N71-28153 16-19)
Avail: NTIS

Results are presented of the theory of differential games of systems with aftereffects associated with the conflict problem of encountering controlled moves with an assigned closed set denominated as the goal. The controlled system is described by the equation dx/dt = f1(t,x1(s),u) + f2(t,x2(s),v), where x is the n-dimensional phase vector; the dimensional vectors u and v are controls governed by the first and second players, respectively, and confined by conditions involving compact sets; and the functions f1(t,x(s),w) are continuous and of the Lipschitz type. Author

N71-28196 National Lending Library for Science and Technology, Boston Spa (England).
THE RELATION BETWEEN THE TACTICS OF THE INVERSE METHOD AND OF THE METHOD OF RESOLUTIONS [SVYAZ MEZHDU TAKTIKAMI OBRATNEGE METEDA I METEDA REZOLYUTSII]
S. Yu. Maslev Oct. 1970 11 p refs Transl. into ENGLISH from Zap. Nauch. Lenin. Otdel. Mat. Inst. im Steklova, Akad. Nauk SSSR (USSR), v. 16, 1969 p 137 - 146
(NLL-RTS-5859) Avail: Natl. Lending Library, Boston Spa, Engl.: 18s; 3 NLL photocopy coupons

Two methods of theorem proving, suitable for machine algorithms and programs, are discussed. A relationship between the resolution principle and the inverse method for automatic establishment of deducibility, is devised. The purpose of such a relationship is to provide a means by which the results of one method can be applicable to the other. E.H.W.

N71-28197# Texas Univ., Austin. Dept. of Electrical Engineering.
JOINT DETECTION-ESTIMATION OF GAUSSIAN SIGNALS IN WHITE GAUSSIAN NOISE
S. K. Park and D. G. Lainiotis Mar. 1971 20 p refs
(Grants AF-AFOSR-1764-69; AF-AFOSR-0766-67)
(AD-722082; AFOSR-TR-71-0950) Avail: NTIS CSCL 9/4

Recent results on joint detection - estimation for discrete data are extended to the continuous case for Gaussian signals in white Gaussian noise. Stochastic differential equations are obtained describing the temporal evolution of the sufficient statistic for the minimum Bayes risk detection and the optimal mean - square error estimate of the signal state vector An approximate solution for the estimation equation is presented and the results are extended to the case of multishot joint detection-estimation. Author (GRA)

N71-28198# Texas Univ., Austin. Dept. of Electrical Engineering.
OPTIMAL ADAPTIVE ESTIMATION: STRUCTURE AND PARAMETER ADAPTATION
D. G. Lainiotis Apr. 1971 31 p refs
(Grants AF-AFOSR-1764-69; AF-AFOSR-0766-67)
(AD-722083; AFOSR-TR-71-0951) Avail: NTIS CSCL 12/1

Optimal structure and parameter adaptive estimators have been obtained for continuous as well as discrete data gaussian process models with linear dynamics. Specifically, the essentially nonlinear adaptive estimators are shown to be decomposable (partition theorem) into two parts, a linear non-adaptive part consisting of a bank of Kalman-Bucy filters, and a nonlinear part that incorporates the adaptive nature of the estimator. The conditional-error-covariance matrix of the estimator is also obtained in a form suitable for on-line performance evaluation. The adaptive estimators are applied to the probelm of state-estimation with nongaussian initial state, to estimation under measurement uncertainly (joint detection-estimation) as well as to system identification. Examples are given of the application of the adaptive estimators to structure and parameter adaptation indicating their applicability to engineering problems. Author (GRA)

N71-28199# North Carolina Univ., Chapel Hill. Dept. of Statistics.
CODES, PACKINGS AND THE CRITICAL PROBLEM, FEBRUARY 1969 - JUNE 1970
Thomas A. Dowling Feb. 1971 23 p refs *Its* Inst. of Statistics Mimeo Series No. 600.34
(Grant AF-AFOSR-1415-68)
(AD-722080; AFOSR-TR-71-0926) Avail: NTIS CSCL 9/4

The report discusses a new approach to a central problem of coding theory. For a given block length and minimum distance constraint, the information rate of a linear code over a finite field is maximized when the code (subspace) has maximum dimension. The problem of determining this maximum dimension, called the coding problem here, can be viewed as a critical problem in combinatorial geometry. As such, its solution depends only on the lattice of subspaces of a certain subgeometry of projective geometry. From knowledge of the characteristic polynomial of this lattice one can immediately determine the maximum dimension of a linear code. The central problem, which is only briefly discussed here, is to determine this polynomial. The well-known connection of the coding problem with the packing problem of projective geometry enables one to approach the packing problem by these methods as well. Author (GRA)

N71-28204# Technische Hogeschool, Delft (Netherlands). Afdeling der Technische Natuurkunde
A METHOD FOR THE CALCULATION OF ORTHOGONAL TRANSFORMATION MATRICES AND ITS APPLICATION TO PHOTOGRAMMETRY AND OTHER DISCIPLINES
Menno Tienstra (Ph.D. Thesis) Dec. 1969 55 p refs
Avail: NTIS

Three dimensional transformations concerned with solving the problem that the coordinates of two sets of conjugate points are known, but in two different coordinate systems and that a determination of the orthogonal relationship between the two coordinate systems is required, are reviewed. The derivation of a procedure in accordance with the method of least squares, for solving the problem is given. It is supposed that redundant data have to be considered and that these data are subject to observational errors. Having obtained this general solution it is shown that for two dimensional transformation a special procedure is finally deduced which is slightly simpler than the general one. A short comparison with the classical theory of observations is included and a number of possible applications is mentioned. Author (ESRO)

N71-28221*# Techtran Corp., Glen Burnie, Md.
APPROXIMATE INTEGRATION OF A BOUNDARY VALUE PROBLEM FOR A NONLINEAR SYSTEM OF DIFFERENTIAL EQUATIONS WITH A DELAYED ARGUMENT [NABLIZHENE INTEGRUVANNIA ODNIEI KRAIOVOI ZADACHI DIIA NELINIYINOI SISTEMI DIFFERENTSIALNIKH RIVNIAN Z ZAPIZNIYUYIYUCHIM ARGUMENTOM]
Yu. I. Kovach et al Washington NASA Jun. 1971 6 p refs Transl. into ENGLISH from Dopovidi Akad. Nauk Ukr. SSR, Ser. A, Fiz.-Tekhn. i Mat. Nauki (Kiev), v. 32, Nov. 1970 p 980 - 982
(Contract NASw-2037)
(NASA-TT-F-13694) Avail: NTIS CSCL 12A

Derivation of a solution to a specific boundary value problem of a nonlinear system of differential equations with a delayed argument is considered. This system is contained in a certain closed region whose projection is a continuous function of the arguments of the system and satisfies the Lipshitz condition. An algorithm is proposed for the approximate integration procedure essential in the solution. Author

N71-28404*# Maryland Univ., College Park. Computer Science Center.
ON A CRITERION FOR DETERMINING THE COMPLETE CONTINUITY OF URYSOHN'S INTEGRAL OPERATOR
T. Nurekenov Jan. 1971 8 p refs Transl. into ENGLISH from Izv. Akad. Nauk Kaz. SSR, Ser. Fiz.-Mat. Nauk (Alma-Ata), v. 15,

no. 3, 1963
(Grant NGL-21-002-008)
(NASA-CR-119014; TR-148) Avail: NTIS CSCL 12A

A nonlinear integral operator is considered where the kernel is a function of the variables. By use of a result called Helly's theorem, which is actually related to Helly's Principle of Choice, the complete continuity of this operator is proved under mild restrictions on the kernel. The theorem may be generalized to other types of nonlinear equations and integral operators in spaces of vectors functions. E.M.C.

N71-28548*# Maryland Univ., College Park. Dept. of Mathematics.
A METHOD FOR APPROXIMATING THE EIGENVALUES OF NON SELF-ADJOINT ORDINARY DIFFERENTIAL OPERATORS
John E. Osborn 28 Jan. 1971 87 p refs
(Grant NGL-21-002-008)
(NASA-CR-119027; TR-71-2) Avail: NTIS CSCL 12A

Non-self-adjoint operators which are lower order perturbations of a self-adjoint operator are approximated assuming the eigenvalues and eigenvectors of the self-adjoint operator are known. Theorems locate the eigenvalues of the non-self-adjoint operator in circles centered at the eigenvalues of the self-adjoint operator. The basic location results are used in the formulation of a method for obtaining improvable approximations by estimating the perturbation of eigenvalues. The Galerkin method is applied to the non-self-adjoint operator using the self-adjoint eigenvectors which are all positive and distinct. Two results are proven and illustrative examples show that explicit estimates for the eigenvalues can be found, if explicit values can be found for the constants in certain inequalities, which hold for all functions in some function space. J.M.

N71-28563# Systems Technology, Inc., Hawthorne, Calif.
TOPICS ON PRACTICAL APPLICATION OF OPTIMAL CONTROL TO SINGLE AND MULTIPLE CONTROL POINT FLIGHT CONTROL PROBLEMS Final Report, Jan.–Nov. 1969
Lee Gregor Hofmann Wright-Paterson AFB, Ohio AFFDL Feb. 1971 138 p
(Contract F33615-69-C-1359)
(AD-722040; TR-187-2; AFFDL-TR-70-52) Avail: NTIS CSCL 1/3

A cadre of techniques is assembled for applying frequency domain optimal control techniques for practical closed-loop controller synthesis. Main emphasis is placed upon obtaining an appropriate formulation of the problem, and upon realizing the optimal control with a reasonably low order closed-loop controller (without resorting to approximation of the control law). Author (GRA)

N71-28565# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
THE EFFECT OF INTERPOLATION OF DATA UPON THE HARMONIC COEFFICIENTS
Pat Avara and Marvin Kays Ft. Monmouth, N.J. ECOM Jan. 1971 35 p refs
(AD-721593; ECOM-5354) Avail: NTIS CSCL 12/1

The practice of interpolating irregularly spaced data to obtain representative values at equally spaced points along the abscissa is quite common in harmonic analysis applications. This interpolation may distort the data sufficiently to cause the spectrum of the interpolated data to bear little resemblance to the original spectrum, especially at high frequencies. The effect of linear interpolation of the data upon its harmonic coefficients is discussed in this report. High frequency waves in the data tend to be destroyed by interpolation and their variance redistributed to other frequencies. When the original data do not contain a particular harmonic, the expected value of the amplitude of that harmonic in the interpolated data varies as a multiple of a Rayleigh variable. The multiplier is a function of the frequencies and amplitudes of the harmonics in the original data and the frequency of the particular harmonic under investigation. Complete folding does not occur. Partial folding or no folding at all can be expected. Tables containing the expected values of some harmonic amplitudes of the interpolated data for various types of original data are provided for comparison purposes. Author (GRA)

N71-28575*# Maryland Univ., College Park. Computer Science Center.
CONTINUATION METHODS FOR NONLINEAR EQUATIONS
John H. Avila Jan. 1971 141 p refs
(Grants NGL-21-002-008; NSF GJ-231)
(NASA-CR-119016; TR-142) Avail: NTIS CSCL 12A

An approach for overcoming the local convergent nature of iterative processes, namely the continuation method, is discussed. The method consists of the following: let F: D is contained in X approaches X be a given mapping on the metric space X and solve the problem F(x) = 0. Numerical continuation, estimating, and problem solving techniques are also discussed. Computational results for the model problem and other examples are given along with several proofs of theorems. E.H.W.

N71-28650* Maryland Univ., College Park. Computer Science Center.
NONLINEAR PROGRAMMING METHODS FOR SOLVING NONLINEAR EIGENVALUE PROBLEMS
Steve W. Rauch Jan. 1971 191 p refs
(Grants NGL-21-002-008; NSF GJ-231)
(NASA-CR-119020; TR-143) Avail: NTIS CSCL 12A

A survey of existence results for a general nonlinear eigenvalue problem in R to the nth power is presented with a discussion of the existence and extendability of continuous branches of eigenvectors and the concept of bifurcation points. The comprehensive convergence theory of Elkin is extended to nonlinear programming, constrained minimization problems with mild conditions and the constraint functionals. The separation of the analysis of the steplength and direction algorithms allows the combination of many different algorithms into convergence theorems for various descent methods. The complete algorithm for finding entire branches of solutions is applied to a nonlinear heat generation problem and to a rotating string problem. Numerical results are given for the two examples. J.M.

N71-28780# Ecole Nationale Superieure des Mines, Paris (France). Centre d'Automatique.
STOCHASTIC MODELING FOR SYSTEMS WITH CONSTANT INTERVALS [MODELISATION STOCHASTIQUE POUR LES SYSTEMES A CONSTANTES REPARTIES]
A. Bensoussan Nov. 1970 16 p refs In FRENCH Presented at the Seminar on Stochastic Models, 26–27 Nov. 1970
(Contract F61052-70-C-0023)
(AD-722091; AFOSR-71-0873TR) Avail: NTIS CSCL 12/1

The problem of definition of white noise with time-and space-parameters is presented. This question leads to the definition of stochastic linear functionnals on Hilbert spaces. The stochastic integrals appear as a particular case of this general functionnals. This notion is used for a formal mathematical description of systems, which are governed by partial differential equations. A new form of stochastic state-variable representation is presented. GRA

N71-28908 California Univ., Los Angeles.
MIXTURES OF DIRICHLET PROCESSES WITH APPLICATIONS TO BAYESIAN NONPARAMETRIC PROBLEMS
Charles Edward Antoniak (Ph.D. Thesis) 1969 65 p
Avail: Univ. Microfilms Order No. 70-14255

Methods of generating random distribution functions proposed by Dubins and Freedman, and Kraft and Van Eeden are described and their relative merits are compared with those of the recently proposed Dirichlet process of Ferguson. A constructive algorithm is given relating the Dirichlet distribution function process to the more general distribution function processes of Kraft and Van Eeden. The concept of a mixture of Dirichlet processes is introduced next, and an example is given showing how a problem originally formulated in terms of a simple Dirichlet process may have to be analysed in terms of mixtures of Dirichlet processes. Several properties of mixtures of Dirichlet processes are developed in propositions and theorems. Dissert. Abstr.

N71-28909 Wisconsin Univ., Madison.
SOLUTION OF CERTAIN CONTROL PROBLEMS IN DISTRIBUTED-PARAMETER SYSTEMS BY USE OF THE CONCEPT OF THE SET OF ATTAINABLE STATES
Mathukumalli Vidyasagar (Ph.D. Thesis) 1969 110 p
Avail: Univ. Microfilms Order No. 70-3733

Control problems of optimal control of linear and a class of nonlinear distributed-parameter systems are considered. The concept of the set of attainable states is used extensively and is shown to greatly simplify the control problems considered. It is shown that if the system operator is representable as an integral operator, then the set of attainable states, with the control function constrained to lie in a closed, bounded, convex set, is closed. Formulations are presented of three general types of problems: (1) fixed end-point problems, (2) minimum-deviation problems and (3) time-optimal problems, in general terms. Geometric interpretations of each of these types of control problems in terms of the set of attainable states are given. Some results on the existence and uniqueness of optimal controls are proved. Dissert. Abstr.

N71-28917# Montpellier Univ. (France). Dept. of Physique Mathematique.
COMPLETE SOLUTION OF THE INVERSE SCATTERING PROBLEM AT FIXED ENERGY
Pierre C. Sabatier (Ind. Univ., Bloomington) Apr. 1971 93 p refs
(PM-71/1) Avail: NTIS

A complete solution of the inverse scattering problem at fixed energy is given in a class Xi prime of potentials which contains Xi. This means that in any given set of phase-shifts bounded by C l(-1-epsilon), all the potentials of Xi prime fit this set of phase shifts which depend on arbitrary function. The fundamental tool in the solution is the scattering structure function. The method is derived in such a way that an approximation theory and numerical computations are feasible. Author

N71-29143 National Lending Library for Science and Technology, Boston Spa (England).
ON THE EQUIVALENT NUMBER OF INDEPENDENT DATA
N. A. Bagrov 1970 11 p refs Transl. into ENGLISH from Tr. Gidrometeorol. Nauchn.-Issled. Tsentr. SSSR (Leningrad), no. 44, 1969 p 3-11
(NLL-M-9263-(5828.4F)) Avail: Natl. Lending Library, Boston Sap, Engl.: 1 NLL photocopy coupon

A method is proposed for determining the number of independent data equivalent to a number of dependent data and its application in practical meteorology and weather forecasting is described. A.L.

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N71-28062*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
STUDY TO IMPROVE THE ACCURACY AND RESOLUTION OF FPS-16 RADAR/JIMSPHERE WIND MEASUREMENTS Final Report
R. E. DeMandel and S. J. Krivo Jun. 1971 40 p refs
(Contract NAS8-26128)
(NASA-CR-118997; LMSC-HREC-D225068; HREC-6128-2) Avail: NTIS CSCL 04B

This discussion examines the following: (1) the scales of atmospheric motions which are measurable with the FPS-16 radar/Jimsphere system and the accuracy of these measurements, (2) the effect of the data processing methods now in use on the fidelity of the measurements, and (3) improvements which can be made in data processing to yield more accurate, higher resolution winds than are now obtained. The proposed improvements will also be shown to alleviate the data storage and retrieval problems which now exist. Author

N71-28129*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
AERODYNAMIC PROPERTIES OF ROUGH SPHERICAL BALLOON WIND SENSORS
George H. Fichtl, R. E. De Mandel (Lockheed Missiles and Space Co.), and S. J. Krivo (Lockheed Missiles and Space Co.) Washington Jun. 1971 30 p refs
(NASA-TN-D-6373; M-169) Avail: NTIS CSCL 04B

A first-order theory of the fluctuating lift and drag coefficients associated with the aerodynamically induced motions of rising and falling spherical balloon wind sensors is developed. The equations of motion of a sensor are perturbed about an equilibrium state in which the buoyancy force balances the mean vertical drag force. It is shown that to within first-order in perturbation quantities the aerodynamic lift force is confined to the horizontal, and the fluctuating drag force associated with fluctuations in the drag coefficient acts along the vertical. The perturbation equations are transformed with Fourier Stieltjes integrals and the resulting equations lead to relationships between the power spectra of the aerodynamically induced velocity components and the spectra of the horizontal lift and drag coefficients. Theory shows that the first-order Fourier components of the horizontally induced lift force lead the horizontally induced velocity vector, and that the induced vertical drag lags the induced vertical velocity for rising balloons and leads the falling balloons. The phase angles of the induced lift and drag associated with frequency omega sub 0 of the Jimsphere balloon are functions of the Reynolds number. Author

N71-28147# Joint Publications Research Service, Washington, D.C.
METEOROLOGY
In its Soviet-Bloc Res. in Geophys., Astronomy, and Space, No. 253 1 Jun. 1971 p 6 39 (See N71-28145 16-30)
Avail: NTIS

News briefs and abstracts of scientific articles concerning Soviet developments in meteorology are presented. Articles included are: use of balloons in studying atmosphere, radar measurement of precipitation, method for predicting seasonal weather, internal waves in a conducting atmosphere, vertical distribution of cloud ice crystals, predicting position of high-altitude frontal zone, results of antihail research, forecasting maximum amount of shower precipitation, and variable directions method in numerical weather forecasting. F.O.S.

N71-28202# Naval Research Lab., Washington, D.C. Atmospheric Physics Branch.
OCEANIC THUNDERSTORMS
Eva Mae Trent and Stuart G. Gathman *In its* Rept. of NRL Progr., Apr. 1971 p 1 6 refs (See N71-28201 16-34)
Avail: NTIS

The oceanic thunderstorm has long been a difficult phenomenon to investigate. The diurnal variation of these storms together with that of land-based storms is essential in providing the statistical correlation between global thunderstorm activity and oceanic potential gradients upon which the classical explanation of the maintenance of the earth's electric charge is based. A data base of over 7-million synoptic observations by ships throughout the world ocean were analyzed to give a fresh approach and insight to the universal time variation of ocean areas affected by thunderstorms. According to these data, the annual average of this ocean area has a mean of 2,020,000 sq km with a diurnal peak 2,400,000 sq km in the interval of 1800 to 2400 GMT. A diurnal minimum is observed to be 1,670,000 sq km in the interval of 0600 to 1200 GMT. Author

N71-28224# National Weather Service, Salt Lake City, Utah.
FORECASTING THE CATALINA EDDY
Arthur L. Eichelberger Feb. 1971 22 p refs
(COM-71-00223; NOAA-NWSTM-WR-62) Avail: NTIS CSCL 04B

The Catalina eddy, a small-scale vortex in the bight of southern California, has long been a serious problem for the forecaster. It disrupts the normal stratus pattern and can cause marked cooling in the southern California coastal area. The eddy is shown to result when an eastward-moving upper trough nears southern California, with strong northerly surface winds prevailing along the California coast. An objective aid for predicting the eddy is presented. It was found that with a surface pressure gradient of five to ten millibars from 35N 125W to Los Angeles, positive vorticity advection resulting in vorticity values of seven to ten units at Los Angeles will generate the eddy. Primitive equation prognostic vorticity charts are shown to be highly useful in forecasting development of the Catalina eddy. Author (GRA)

N71-28225# California Univ., Davis. Dept. of Water Science and Engineering.
ANALYSES OF ENERGY, MOMENTUM, AND MASS TRANSFERS ABOVE VEGETATIVE SURFACES Final Report
D. L. Morgen, W. O. Pruitt, and F. J. Lourence Feb. 1971 131 p refs
(Grant DA-AMC-28-043-68-G10)
(AD-721301; ECOM-68G10-F) Avail: NTIS CSCL 4/2

Extensive surface shear-stress and wind-profile measurements during six separate field studies at Davis, California, indicate a value for the von Karman constant, k, of 0.42. Expressions relating k sub m to the Richardson number for both stable an unstable conditions, based on the Davis data, are presented and compared favorably with the findings of several others. Expressions relating the diabatic wind profile functions to both the Richardson number and z/L are developed and compared with the results of many other researchers. Author (GRA)

N71-28313# Environmental Science Services Administration, Rockville, Md. BOMAP Office.
MASS, MOMENTUM, AND ENERGY BUDGET EQUATIONS FOR BOMAP COMPUTATIONS
Eugene M. Rasusson Jan. 1971 41 p refs
(COM-71-00195; NOAA-TM-ERL-BOMAP-3) Avail: NTIS CSCL 04B

Atmospheric budget equations for mass, momentum, and energy are derived for an x, y, p^* coordinate system, where p^* is the pressure differential relative to sea level. These basic equations are then modified for use in computing the budgets of mass, momentum, and energy for the atmospheric part of the BOMEX volume, as related to the Barbados Oceanographic and Meteorological Experiment (BOMEX), May July, 1969. Author (GRA)

N71-28486# Rosenstiel School of Marine and Atmospheric Sciences, Miami, Fla.
FLORIDA CUMULUS SEEDING EXPERIMENT 1970: SILVER CONTENT OF PRECIPITATION Final Report, 5 May–4 Oct. 1970
H. Goete Oestlund and Robert D. Stearns Mar. 1971 12 p refs
(Contract N00173-70-C-0684)
(AD-721740; ML-71021) Avail: NTIS CSCL 4/2

Evaporation of rainwater samples is a feasible method for the enrichment of silver. Atomic evaporation is easily brought to a sensitivity of 10 to the minus 10th power g of Ag or better as a limit of detection. The aircraft sampling problem is presently the worst obstacle. Adsorption on plumbing and sample containers on board the aircraft can very efficiently remove all or part of the silver from each sample. This is the problem that has to be solved before useful results can be obtained of presence of silver in seeded rains. Author (GRA)

N71-28457# Naval Underwater Systems Center, New London, Conn. E/M Environment and Optical Systems Div.
A SURVEY OF METHODS OF SIZING AND COUNTING WATER DROPLETS IN CLOUDS
Frederick C. Allard 28 Dec. 1970 41 p refs
(AD-721677; NUSC/NL-4007) Avail: NTIS CSCL 4/2

Various methods for sampling natural cloud droplets are reviewed with particular reference to their suitability for use on aircraft. For convenience the methods are divided into two categories: impaction sampling and optical sampling. The older methods, which are still in use, involve the impaction of water droplets on suitably prepared targets. Such targets may capture the droplets in an oil coating or many replicate the droplets by means of pits in a soot coating. The droplet spectrum may be determined by examining the targets of pits in a soot coating. The droplet spectrum may be determined by examining the targets under a microscope. Within the past decade and a half, optical methods have been developed to replace the impaction methods. These methods, notably those involving scattering or diffraction, allow large numbers of droplets to be sized in much less time than is possible with the impaction methods. Author (GRA)

N71-28473# Emmanuel Coll., Boston, Mass. Physics Research Div.
ANALYSIS OF STRATOSPHERIC BALLOON PROGRAMS Final Report, 1 Jan. 1968–31 Dec. 1970
Patricia M. Hagan 31 Mar. 1971 20 p refs
(Contract F19628-68-C-0065)
(AD-722076; AFCRL-71-0115) Avail: NTIS CSCL 4/2

The work under this contract has been computational and analytical services in support of operations analysis, applications research and post flight analysis of stratospheric scientific balloon programs conducted by the Air Force Cambridge Research Laboratories (AFCRL). Geophysical and flight data, furnished by the Government, were utilized for transcription, analysis, graphing, and mathematical computations. The work performed includes hand and machine plotting and the writing of several computer programs. Author (GRA)

N71-28586# California Univ., Los Angeles. Dept. of Meteorology.
A STUDY OF THE CALIFORNIA RAINSTORM OF JANUARY 1969 Final Report
William Bonner, Charles Pyke, and Richard Hickey Jan. 1971 53 p refs
(Contract NOAA-E-3270(N))
(COM-71-00236; NOAA-71021801) Avail: NTIS CSCL 04B

The weather events and forecasting errors in predicting the California rainstorms that occurred between 18 and 26 January 1969 were studied. Rainfall occurred in connection with a large-scale blocking pattern in the eastern Pacific. Disturbances from middle latitudes moved south of the block into subtropical regions, initiating strong convection within the moist tropical air. Failure to predict the onset of rain was associated with errors in numerical

forecasts by the NMC primitive equation model. These errors probably arose from poor initial analyses which failed to identify a major disturbance as it moved into the long wave trough position in the southern branch of the current. Author (GRA)

N71-28556# New York Univ., N.Y. School of Engineering and Science.
STRUCTURE AND REGULARITY OF WIND CURRENT IN SNOW BLIZZARDS
A. K. Djunin 1971 21 p refs Transl. into ENGLISH from Russian report Sponsored by Army
(AD-721739; CRREL-TL257) Avail: NTIS CSCL 8/12

The snow cover and its variations are very important to agriculture and transportation. The most important is the drifting snow. But its behavior has not been well studied. The author tries to find similarities between the drifting snow and the transfer of heavy particles by liquid currents and in this way the author correlates the process of snow blizzard with the transfer process of sand particles in water and in air. The following 2 essential problems are taken into consideration: the structure of the transferred material as defined by its granulometric composition, and the weight of the transferred materials moving in a unit time period. Author (GRA)

N71-28598# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
SUMMER MESOSCALE WIND STUDY IN THE REPUBLIC OF VIETNAM
Joseph R. Levine Ft. Monmouth, N.J. ECOM Dec. 1970 25 p refs
(AD-721585; ECOM-3375) Avail: NTIS CSCL 4/2

Linear correlation of wind speeds between five locations in South Vietnam was accomplished for the summer of 1967. The study was done to determine if fewer observation sites could provide wind-speed information that would be representative of the area, with sufficient accuracy for the U. S. Army Artillerys needs. Results showed that although many significant correlations were determined, the unexplained variance was too great to allow this approach for use by the artillery, although other wind-speed users might find it acceptable. Author (GRA)

N71-28587# Control Data Corp., Minneapolis, Minn. Research Div.
CHARACTERISTICS OF TROPICAL WIND FLOW PATTERNS Final Report, 1 Feb. 1969 – 31 Jan. 1971
D. G. Dartt 15 Feb. 1971 50 p refs
(Contract DAHC04-69-C-0046)
(AD-721365; AROD-7725.3-EN) Avail: NTIS CSCL 4/2

The Final Report consists of three parts: (1) Automated Streamline Analysis Utilizing Optimum Interpolation. (Revised version of paper presented at the WMO Tropical Symposium, Honolulu, 1971, and submitted for publication to Journal of Applied Meteorology.) (2) Appendix to above paper, consisting of examples of automated analysis of streamlines, streamfunctions, divergence and vorticity in the tropics. (3) Feasibility of Objective Wind Analysis Using satellite Cloud Data. This was a preliminary experiment to related digitized ATS-1 cloud brightness to the vorticity and divergence fields of the tropic winds. Author (GRA)

N71-28598# Wisconsin Univ., Madison. Space Science Engineering Center.
STUDIES OF THE ATMOSPHERE USING AEROSPACE PROBINGS Annual Report, 1969
Verner E. Suomi Nov. 1970 249 p refs
(Grant ESSA-E-230-68-(G))
(COM-71-00216; NOAA-71020806) Avail: NTIS CSCL 04B

The major portion of the annual report is concerned with theoretical studies of atmospheric dynamics. Such notions as three dimensional convection models, inertial instability, the influence of latitudinal wind shear, Ekman layer convergence, and boundary layer dynamics are discussed. Application of satellite data to cyclone motion and severe local storm is included. An engineering study of real time ATS data processing is also included. Author (GRA)

N71-28599# Naval Postgraduate School, Monterey, Calif.
A DIAGNOSTIC STUDY OF GREAT PLAINS TORNADO CONDITIONS
Alfred Addison Thresher, II (M.S. Thesis) Mar. 1971 65 p refs
(AD-721580) Avail: NTIS CSCL 4/2

A study is made of a severe storm system that traversed the mesoscale network in Oklahoma on 10 June 1967. Synoptic data, and mesoscale data covering the period from 2300 GMT to 0600 GMT, are used to investigate synoptic atmospheric conditions indicative of severe storms, and the dynamic and thermodynamic properties of the air in proximity to a tornado. In this case study, presence of low level moisture and elimination of the inversion are shown to be necessary but not sufficient conditions for the release of latent instability; a lifting mechanism is required. It is shown that having the largest negative Showalter Index in an area does not in itself guarantee a severe storm or tornado. The observed release of latent instability was associated with the passage of a squall line and the presence of an upper level short wave. Author (GRA)

N71-28601# Booz-Allen Applied Research, Inc., Bethesda, Md.
A STATISTICAL DATA PLAN FOR BOMEX Final Report
Theodore W. Horner Dec. 1970 119 p refs
(Grant ESSA-E-192-69-(N))
(COM-71-00188; NOAA-TM-ERL-BOMAP-2) Avail: NTIS CSCL 04B

The Barbados Oceanographic and Meteorological Experiment (Project BOMEX) was the first of a series of large-scale research projects planned by many nations throughout the world under the Global Atmospheric Research Project (GARP). The primary goal of the BOMEX project was to provide data for studying the sea-air interaction that drives atmospheric circulation and global weather systems. The project was conducted from May through July of 1969 and produced substantial quantities of data that were recorded manually, on magnetic tapes, and on charts. The reduction of the raw data to a form useful for scientific investigation and for storage in scientific archives is the responsibility of the Barbados Oceanographic and Meteorological Analysis Project (BOMAP), a project established within the Research Laboratories of the Environmental Science Services Administration. Author (GRA)

N71-28645# Edgerton, Germeshausen and Grier, Inc., Waltham, Mass. Cambridge Systems Div.
DEVELOPMENT OF FAST RESPONSE TEMPERATURE AND WATER VAPOR SENSORS Final Report, 15 Jul. 1965 – 31 May 1970
Arthur Bisberg Dec. 1970 126 p refs
(Contract AF 19(628)-5521)
(AD-721456; AFCRL-70-0695) Avail: NTIS CSCL 4/2

The design and development of high speed, and high resolution sensors for micrometeorological measurements of atmospheric temperature and water vapor is described. The significant characteristics are a rapid response (time constant of 0.05 sec.), and high resolution (0.01C temperature and 0.05 gm/cubic meter water vapor) combined with a 20 cm vertical sensing path length and good long-term stability. The instruments have been designed for a specific meteorological study and will interface with other existing equipment both as regards the output signals and the physical mounting of the sensor heads. Detailed design and error analysis is presented. Author (GRA)

N71-28646# Meteorology Research, Inc., Altadena, Calif.
AIRCRAFT PROBING OF HAILSTORMS Final Report, Fiscal Year 1969
Robin E. Williamson 14 Jan. 1969 31 p Prepared for S. Dak.

School of Mines and Tech.
(Grant NSF GA-935)
(MRI-69-FR-841) Avail: Issuing Activity

The feasibility of using a manned armored North American T-28B aircraft to explore hail breeding zones of severe storms was investigated. Wing panels with various thicknesses of armor were tested in facilities capable of projecting ice balls up to three inches in diameter, at speeds up to 500 ft per second. It was concluded that the theoretical method developed for determining the necessary thickness of armor gives valid results, and that it is feasible to modify an aircraft for this task. F.O.S.

N71-28884# Weather Bureau, Silver Spring, Md.
FEDERAL METEOROLOGICAL HANDBOOK NO. 1: SURFACE OBSERVATIONS
1 Jan. 1971 220 p Sponsored in part by Dept. of Commerce, DOD, DOT and Navy
(AD-720106; AD-698884; NAVAIR-50-ID-1-CH-1) Avail: NTIS Supersedes AD-698884; 7th Ed. WBAN Circ. N; See N70-24418 CSCL 4/2

This handbook prescribes uniform instructions for standard weather observing and reporting techniques. It is intended to provide a framework within which the observer can find a system for identifying meteorological phenomena and reporting their occurrence in an understandable format. Agreements with the World Meteorological Organization, international and domestic aviation interests, and civil and military weather service provide the basis to which standards are developed. Author (GRA)

N71-28895# Finnish Meteorological Office, Helsinki.
FINNISH METEOROLOGICAL INSTITUTES'S AIR TEMPERATURE AND PRECIPITATION PREDICTION SUMMARY (4 PM WEATHER FORECASTS) [ILMATIETEEN LAITOKSEN LAEMPOETILA- JA SADE-ENNUSTEIDEN ('SAEAETIEDOTUS KLO 16') OSUVUUDESTA]
Juhani Hankimo 1970 26 p refs In FINNISH
(RR-32) Avail: NTIS

Tables are presented of monthly, seasonal, and annual minimum and maximum air temperature predictions compared with data recorded at five weather stations in Finland from January 1968 through October 1970. Precipitation prediction records are correlated with observed weather conditions using frequency distribution percentages by seasons. Prediction probabilities are shown for each weather station in five seasonal rainfall measurement categories. Transl. by O.C.

N71-28896# Finnish Meteorological Office, Helsinki.
MAXIMUM AND MINIMUM AIR TEMPERATURE DISTRIBUTIONS AT VARIOUS LOCALITIES IN FINLAND, 1931 – 1960 [MAKSIMI- JA MINIMILAEMPOETILOJEN JAKAUTUMINEN ERAEILLAE SUOMEN PAIKKAKUNNILLA VUOSINA, 1931 – 1960]
Erkki Harjama and Erkki Laitinen 1970 61 p refs In FINNISH
(RR-31) Avail: NTIS

Distribution data are tabulated for minimum and maximum air temperatures at nine Finnish localities for the years 1931 through 1960. The temperature distributions are given as percentages of the entire collection on a semimonthly basis for each locality. Transl. by O.C.

N71-28977# South Carolina Pollution Control Authority, Columbia. Div. of Air Pollution Control.
WIND STATISTICS FOR SELECTED STATIONS
John C. Purvis 1 Feb. 1971 17 p refs Sponsored by NOAA
(COM-71-00214; NOAA-71021003) Avail: NTIS CSCL 04B

Wind statistics for selected stations in and near South Carolina, to provide a ready reference for air pollution control interests, are presented. Author (GRA)

N71-29000+ Finnish Meteorological Office, Helsinki.
MONTHLY REVIEW OF THE CLIMATE IN FINLAND DURING JANUARY 1971 [KUUKAUSIKATSAUS SUOMEN ILMASTOON, TAMMIKUU 1971 JANUARI]
Jan. 1971 11 p In SWEDISH and FINNISH
Avail: NTIS

Tabulations and charts are presented of air temperatures, humidity, cloud conditions, and related weather observations recorded at sixty agricultural and air stations in Finland during January 1971. Daily readings as well as monthly averages, highs and lows, humidity, rainfall, and related data are printed adjacent to 30-year averages (1931 – 1960) for the observation stations involved. Chart headings and text are printed in both Finnish and Swedish. Transl. by O.C.

N71-29001# National Weather Service, Garden City, N.Y.
A PRELIMINARY CLIMATOLOGY OF AIR QUALITY IN OHIO
Marvin E. Miller Jan. 1971 15 p refs
(NOAA-TM-NWS-ER-39; COM-71-00204) Avail: NTIS CSCL 13B

The report discusses established standards for ambient air in Ohio and observed trends in Ohio urban pollution levels for which standards have been set. To date, Ohio has established air quality standards for suspended particulates and sulphur dioxide. The data presented indicate the trend within most Ohio urban areas since the early 1960's has been toward lower suspended particulate and dustfall loadings. Little can be said regarding the trends in sulphur dioxide levels because of relatively short periods of sampling. Author (GRA)

N71-29076# Arctic Inst. of North America, Washington, D.C.
CLIMATE AND ENERGY EXCHANGE ON A SUB-POLAR ICE CAP IN SUMMER. PART A: PHYSICAL CLIMATOLOGY
Bjoern Holmgren 1971 88 p refs
(Contract Nonr-1138(01))
(AD-721546) Avail: NTIS CSCL 4/2

The analysis is based on climatological and micro-meteorological measurements made mainly at an elevated observation-place (Ice Cap Station, 1.3 km above M.S.L.) in the area of superimposed ice formation on the northwest slope of the ice cap. Comparative measurements were temporarily made in different parts of the ice cap. The structure of the wind-field over the ice cap, especially in situations with katabatic winds, was investigated by means of pilot balloons. In the middle of the summer the low-lying parts of the ice cap and the outlet glaciers are invaded by air of temperatures above freezing. Since the temperature of the ice cannot rise further than to melting-point, an advection inversion develops above the surface. Over the high-lying parts of the ice cap the air temperature in general stays well below freezing. Here the radiation climate is the factor which dominates the temperature stratification in the surface layer. At Ice Cap Station the conditions are intermediate in this respect; air temperatures above freezing were obtained in about 40% of all temperature readings at screen level in July. Author (GRA)

N71-29077# Uppsala Univ. (Sweden). Meteorologiska Inst.
CLIMATE AND ENERGY EXCHANGE ON A SUB-POLAR ICE CAP IN SUMMER, ARCTIC INSTITUTE OF NORTH AMERICA DEVON ISLAND EXPEDITION, 1961 – 1963. PART B: WIND- AND TEMPERATURE-FIELD IN THE LOW LAYER ON THE TOP PLATEAU OF THE ICE CAP
Bjoern Holmgren 1971 47 p refs *Its* Meddelande No. 108
(Contract Nonr-1138(01))
(AD-721486) Avail: NTIS CSCL 4/2

Observations of the vertical variation of wind speed in near-neutral stratifications show an increase of the roughness parameter z sub 0 from about 0.00005 to 0.001 m when the wind speed at the 5 m level decreases from 6 - 7 m/sec to 2 - 3

m/sec. The increase of z sub 0 is suggested to be related to the flow conditions at the rear of the snow dunes. Snow dunes were characteristic features of the surface relief in the observation area. Possible causes of the observed profile features, especially the influence of the local conditions, are discussed. Author (GRA)

N71-29078# Uppsala Univ. (Sweden). Meteorologiska Inst.
CLIMATE AND ENERGY EXCHANGE ON A SUB-POLAR ICE CAP IN SUMMER, ARCTIC INSTITUTE OF NORTH AMERICA DEVON ISLAND EXPEDITION, 1961–1963. PART C: ON THE KATABATIC WINDS OVER THE NORTHWEST SLOPE OF THE ICE CAP. VARIATIONS OF THE SURFACE ROUGHNESS
Bjoern Holmgren 1971 48 p refs *Its* Meddelande No. 109
(Contract Nonr-1138(01))
(AD-721487) Avail: NTIS CSCL 4/2

The stability conditions in situations with katabatic flows and the magnitude of the forces influencing the air in the inversion layer over the sloping surface are discussed. An analytical description of the profiles in the lowest layer above the snow-surface is given together with equations for the vertical heat flux during inversion conditions. A comparison of the vertical heat flux determined over the quasi-horizontal surface of the top plateau with the heat flux obtained at Ice Cap Station is also included. Author (GRA)

N71-29079# Uppsala Univ. (Sweden). Meteorologiska Inst.
CLIMATE AND ENERGY EXCHANGE ON A SUB-POLAR ICE CAP IN SUMMER, ARCTIC INSTITUTE OF NORTH AMERICA DEVON ISLAND EXPEDITION, 1961–1963. PART D: ON THE VERTICAL TURBULENT FLUXES OF WATER VAPOUR AT ICE CAP STATION
Bjoern Holmgren 1971 34 p refs *Its* Meddelande No. 110
(Contract Nonr-1138(01))
(AD-721488) Avail: NTIS CSCL 4/2

The vertical turbulent flux of water vapour E at the snow surface is calculated by means of three-hourly determinations of wind speed at a low level, (0.5 - 1.0 m); water-vapour pressure at 1.5 m; and temperature profiles for indirect determination of the temperature and water-vapour pressure at the snow surface. The temperature of the snow surface is determined by extrapolation of temperature-profiles down to the snow surface. The method is calibrated by reference to the conditions over melting snow. Humidity profiles measured with Assmann psychrometers at different levels are also utilized in the analysis of the humidity-field in the layer below the 1.5 m level. The discussion includes a comparison with a semi-empirical model suggested by Sverdrup. The variations of E in different weather situations are described. Author (GRA)

N71-29080# Arctic Inst. of North America, Washington, D.C.
CLIMATE AND ENERGY EXCHANGE ON A SUB-POLAR ICE CAP IN SUMMER. PART E. RADIATION CLIMATE
Bjoern Holmgren 1971 117 p refs
(Contract Nonr-1138(01))
(AD-721489) Avail: NTIS CSCL 4/2

The main topic of this paper is the relationship between the variations of the radiation fluxes and the albedo at an observation-place on the north-west slope of the ice cap at an altitude of 1.3 km above M.S.L. and at a distance of ca 10 km from the margin of the ice cap. The radiation climate is described by means of measurements with the Angstrom pyrheliometer, two standard models of pyranometers (Eppley and Moll-Gorczynski), the Beckman + Whitley net radiometer and also photo-cells in combination with filters. The photo-cells are used for determinations of the albedo, the penetration of light into the snow pack, and the intensity of light from different parts of the sky. Author (GRA)

N71-29081# Uppsala Univ. (Sweden). Meteorologiska Inst.
CLIMATE AND ENERGY EXCHANGE ON A SUB-POLAR ICE CAP IN SUMMER, ARCTIC INSTITUTE OF NORTH AMERICA DEVON ISLAND EXPEDITION, 1961–1963. PART F: ON THE ENERGY EXCHANGE OF THE SNOW SURFACE AT ICE CAP STATION
Bjoern Holmgren 1971 66 p refs *Its* Meddelande No. 112
(Contract Nonr-1138(01))
(AD-721490) Avail: NTIS CSCL 4/2

Micro-meteorological measurements at an observation-place situated at 1.3 km above M.S.L. on the north-west slope of the Devon Island ice cap are utilized to study the interplay between the energy transfers above and below the snow surface in various weather situations. The calculations of the energy budget is checked by summing up all energy fluxes during three observation-periods covering the summers of 1962 and 1963. Author (GRA)

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N71-28060# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
OPTIMAL CONTROL FOR UNCERTAIN SYSTEMS Final Report, 1 Feb. 1969–31 Jan. 1971
Michael Athans Mar. 1971 34 p refs
(Grant AF-AFOSR-7124-69)
(AD-721470; ESL-FR-445; AFOSR-TR-71-0835) Avail: NTIS CSCL 12/1

Contents: Decentralized control for large scale systems; Resource allocation problems; Estimation techniques; Stochastic control and compensation methods; Deterministic compensator design; Differential games and vector-valued criteria; and Air traffic control. GRA

N71-28241# Systems Technology, Inc., Hawthorne, Calif.
AN ANALYSIS OF NAVY APPROACH POWER COMPENSATOR PROBLEMS AND REQUIREMENTS Final Report
S. J. Craig, R. F. Ringland, and I. L. Ashkenas Mar. 1971 303 p refs
(Contract N62269-70-C-0172)
(AD-722025; STI-TR-197-1) Avail: NTIS CSCL 17/7

Analyses of the current Navy Approach Power Compensator System (APCS) ARE MADE FOR MANUAL AND Automatic Carrier Landing System (ACLS) operations. Major problem areas are identified and these are correlated with the changes in the aircraft dynamic characteristics resulting from incorporation of the current APCS concept, which uses angle of attack, normal acceleration, and elevator deflection as input signals to control thrust. Root causes and basic limitations are developed using open and closed-loop servo analysis techniques to study the combined pilot/APCS/aircraft system and the automatic control situation (i.e., ACLS). Particular attention is given to developing literal approximate expressions to connect APCS and basic airframe parameters. Basic APCS design implications and compromises are implied from these expressions. A critique is given of APCS specifications and test procedures as presently employed during carrier suitability evaluation. Author (GRA)

N71-28460*# Lockheed Aircraft Corp., Burbank, Calif.
SOLAR ENERGY POWERED HELIOTROPE Patent Application
R. Crawford Byxbee, inventor (to NASA) 23 p Filed 25 Sep. 1970
(Contract NAS5-11637)
(NASA-Case-GSC-10945-1; US-Patent-Appl-SN-75431) Avail: NTIS CSCL 17G

A solar energy powered heliotrope for orienting a solar array towards the sun is described. The heliotrope is designed to operate in a passive stored energy manner; reorientation of a solar array from any degree of misorientation is possible because a sensor coil constantly detects misorientation and stored energy is always available to provide solar array rotation/orientation. A working model has been constructed and tested for thermal response and test results indicate the feasibility of future potential future use on spacecraft. NASA

N71-28461*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MAGNETIC BEARING Patent Application
Philip A. Studer, inventor (to NASA) 14 p Filed 22 Dec. 1970
(NASA-Case-GSC-11079-1; US-Patent-Appl-SN-100637) Avail: NTIS CSCL 17G

A magnetic bearing includes a pair of coaxial, toroidal, permanent magnets having axially directed poles. Like poles of the permanent magnets are adjacent each other. An electromagnet is wound coaxially with the permanent magnets in such a manner that the poles are axially directed. Between the poles of each permanent magnet there is a low magnetic reluctance circuit including two series air gaps. Between the poles of the electromagnet a low reluctance path including one air gap of each of the low magnetic reluctance circuits and a ring axially translatable relative to the permanent magnets. The ring forms opposite faces of the air gaps in the magnetic circuits for each permanent magnet. The bearing is applicable to spacecraft control system drives, high accuracy pointing systems, motor generator systems, and very high velocity rotating equipment. NASA

N71-28462# Naval Postgraduate School, Monterey, Calif.
A COMPREHENSIVE INVESTIGATION OF THE VLF LONG RANGE NAVIGATION SYSTEM
Joseph Harvey Adams (M.S. Thesis) Dec. 1970 83 p refs
(AD-721549) Avail: NTIS CSCL 17/7

The highly stable propagation characteristics of VLF transmissions make them an ideal source of world-wide navigation data. The arrival phase of a VLF signal is continuously compared with a local standard. The change in the phase difference between the received signal and the local standard is converted to relative motion with respect to the VLF transmitter. This investigation concerns itself with the development as a whole of the VLF navigation system. Refinements are made in the antenna system and the antenna signal processing. In addition, navigation procedures, tables, and forms are presented for system use. Author (GRA)

N71-28570# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
NAVIGATION AT THE PRIME MERIDIAN
G. Gebel and B. Matthews (Elliott Bros., Ltd.) Aug. 1970 19 p refs
(Contract NOw-62-0604-c)
(AD-721335; APL-TG-1131) Avail: NTIS CSCL 17/7

An experiment was conducted to establish the relation between the longitude reference of the Navy Navigation Satellite System and the international longitude reference at Greenwich. If the Greenwich Meridian is to have 0 degrees longitude in the Transit Coordinate System, the user must add 5.64 seconds to all longitude measurements. Author (GRA)

N71-28685# Lincoln Lab., Mass. Inst. of Tech., Lexington.
AIR TRAFFIC CONTROL Quarterly Technical Summary Report, 1 Nov. 1970 – 31 Jan. 1971
Herbert G. Weiss 15 Feb. 1971 17 p
(Contract F19628-70-C-0230)
(AD-721463; ESD-TR-71-16) Avail: NTIS CSCL 17/7

The Lincoln Laboratory Air Traffic Control program includes investigations related to the development of improved surveillance and communications capability to support the needs of the automated air traffic control system. Recent work on the beacon system and on tracking studies is reported. Technical studies on Fourth Generation Air Traffic Control System Concepts are reported. New studies, on the Discret Address Beacon System (DABS) COMMENCED. A technical development plan for the DABS is being prepared; its scope is described. The simulation studies and system planning of an airborne traffic situation display which will provide pilots with a suitably edited and formatted display of traffic information in the terminal area are continuing. Field testing is proceeding on a prototype laser warning system which has been designed to alert the tower controllers at Logan Airport of the presence of a ship with a tall mast in the shipping channel which crosses the approach path to Runway 4R. GRA

N71-28772 Wisconsin Univ., Madison.
AN ANALYSIS OF SOLAR ASTRONAVIGATION IN HIGH LATITUDES
Gerald Winford Johnson (Ph.D. Thesis) 1969 116 p
Avail: Univ. Microfilms Order No. 70-3569

Problems of determining geographical positions by astronavigation in the Arctic and Antarctic are investigated. The research is directed primarily toward problems associated with the use of the sun, but the results are applicable to all celestial observations. The question of the reliability of current refraction tables when used in the Arctic is investigated. The refraction integral is numerically integrated, using radiosonde data from Thule Air Base in Greenland, to determine the refraction for a range of zenith angles. The values of refraction obtained from the radiosonde data are compared with values from existing refraction tables to determine the validity of these when used in the Arctic. Results from the Thule radiosonde, although limited in time to a six week summer period, indicate that refraction may be more reliable than presently thought. Except for extremely large zenith angles, the values show a high degree of precision. It is concluded that for polar astronavigation the sun can be used to obtain an acceptable degree of precision, and that with additional studies, refraction need not be a limiting factor in the use of the sun. Dissert. Abstr.

N71-28930*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A UNIFIED FORMALISM FOR POSITION DETERMINATION FROM VARIOUS NAVIGATION MEASUREMENTS
Homer Q. Lee Washington Jul. 1971 28 p refs
(NASA-TN-D-6417; A-3875) Avail: NTIS CSCL 17G

A technique has been developed for coordinate determination of moving vehicles. Its application offers a unified description for extracting position information from various combinations of measurements such as range, range rate, angle, distance sum, and distance difference. Specifically, the desired coordinates are obtained by a matrix multiplication of a column matrix obtained from given measurements. Various combinations of measurements affect only the method of constructing the column matrix. The matrix that transforms the column matrix into desired coordinates depends only on the known coordinates of reference points. This matrix also transforms the error covariance matrix in measurements into an error covariance matrix in computed coordinates. Author

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N71-28081# General Electric Co., Sunnyvale, Calif.
SOUTHWEST EXPERIMENTAL FAST OXIDE REACTOR DEVELOPMENT PROGRAM Quarterly Report, Aug. – Oct. 1970
G. R. Pflasterer and R. A. Becker, comps. Nov. 1970 102 p refs Prepared for Southwest Atomic Energy Associates
(Contract AT(04-3)-540)
(GEAP-10010-26; QR-26) Avail: NTIS

Fuel element fabrication methods and design parameters of PuO2 and UO2 type rods are presented for the Southwest experimental fast oxide reactor. Physics measurements, maintenance, and operations are given for August to October 1970. Startup tests are included. E.H.W.

N71-28084# Hittman Associates, Inc., Columbia, Md.
THERMAL-HYDRAULIC ANALYSIS AND TECHNICAL SPECIFICATIONS FOR THE PM-3A TYPE 4 CORE
Nov. 1970 40 p refs
(Contract AT(30-1)-3775)
(HIT-465) Avail: NTIS

A thermal-hydraulic analysis for the PM-3A Type 4 Replacement Core was performed to determine the effects of variations in core coolant flow, system pressure, core lifetime, and coolant temperature on the steady state burnout power level in the channel of the core having the greatest heat input and at the hot spot in that channel. The most limiting combination of the process variables examined was 2000 gpm, 1300 psia, 15 MW-yr, and 510 F, respectively. Several DNB correlations were used in the analysis and it was found that the Tong correlation was the most limiting. These limiting conditions were corrected for measurement and instrument uncertainties and these results are presented. Transient analyses for the Type 4 core were reviewed to determine in effect of postulated accidents on the thermal limitations. Specifically, a rod withdrawal accident from power was found to be the most detrimental with respect to possible burnout in the limiting channel. It was shown that the maximum heat flux during this rod withdrawal accident is less than that for steady state operation at the high power trip point. Therefore, no allowance was necessary for abnormal transients. The power level Safety Limit for the Type 4 Replacement Core was determined to be 157% of 11.27 MW(t). Author (NSA)

N71-28101# Oak Ridge National Lab., Tenn.
ORNL NUCLEAR SAFETY RESEARCH AND DEVELOPMENT PROGRAM Bimonthly Report, Nov. – Dec. 1970
Wm. B. Cottrell Mar. 1971 123 p refs
(Contract W-7405-eng-26)
(ORNL-TM-3263) Avail: NTIS

Much of this work is in general support of water-cooled power reactor technology, including LOFT and industry programs, and reflects current safety problems, such as measurements of prompt fuel element failure phenomena and the problems associated with the long-term operation of containment spray systems. Several projects are also conducted in support of the high-temperature gas-cooled reactor and liquid-metal fast breeder reactor programs. Other major projects are those on primary piping and steel pressure-vessel technology. They also include experimental investigations of the attachment of nozzles to shells and the implementation of joint AEC-PVRC programs on heavy-section steel technology and nuclear piping, pumps, and valves. Seismic considerations of particular significance in nuclear plant design are being evaluated in the seismic program. Of particular interest in both of these activities is the recent emphasis on environmental effects. Author (NSA)

N71-28106# General Electric Co., Sunnyvale, Calif.
FUMBLE: AN APPROACH TO FAST POWER REACTOR FUEL MANAGEMENT AND BURNUP CALCULATIONS
P. Greebler and C. L. Cowan Nov. 1970 516 p refs
(Contract AT(04-3)-189)
(GEAP-13599) Avail: NTIS HC$6.00/MF$0.95

The FUMBLE computes the fuel burnup in reactor operations. This includes the evaluation of reactivity effects, breeding (or depletion) and inventories of fuel, and fuel costs for changing economic conditions and supplied fuel compositions through the reactor lifetime (or for as many refueling operating intervals as desired). Fuel cost components associated with fabrication and reprocessing are computed using input data parameters such as reprocessing time, fissile material losses, unit fabrication costs, etc. Considerable flexibility is allowed in the specifications of reactor refueling. The refueling specifications may be changed from one refueling operating interval to another, as well as operating interval time, power rating, and load factor. Fuel costs may be evaluated for several different sets of cost input data and may be based on net costs accrued and energy produced by spent fuel batches and/or on net costs incurred for all fuel held and energy produced by the entire reactor for each operating interval. The FUMBLE is written almost entirely in FORTRAN-4 for the GE 635 computer. Author (NSA)

N71-28117# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
DIGITAL PROGRAMS FOR THERMAL DYNAMICS OF A CYLINDRICAL NUCLEAR FUEL ROD AND A HEAT EXCHANGER TUBE
S. Petrarca and E. Cosimo 24 Mar. 1970 57 p refs
(RT/ING-(70)8) Avail: AEC Depository Libraries

FORTRAN 4 digital codes used to study the thermal dynamics of a solid or hollow cylinder, with or without distributed heat generation, are presented. Thermal conductivity and diffusivity of the cylinder are assumed to be constant and the thermal power density is uniform. The surfaces of the cylinder are assumed either insulated or in thermal contact with moving fluids; the heat exchange coefficients between the cylinder and the fluid are assumed either constant or linearly dependent on fluids flow rates. The codes apply to the fuel rods of many nuclear reactors, to heat exchanger tubes, to electrically or inductivity-heated cylinders or tubes, and to other similar cases. The codes provide transfer functions from thermal power density and from boundary temperatures and flow rates to the cylinder temperature; moreover, they allow the frequency analysis of the cylinder behavior, by means of Bode diagrams of all the transfer functions concerned. Author (NSA)

N71-28119*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A METHOD FOR PRODUCING MONOENERGETIC NEUTRONS AT KILOVOLT ENERGIES
Stephen E. Binney, Harvey Amster, Rudolph J. Henninger, and Hans Mark Washington Jun. 1971 11 p refs
(NASA-TM-X-2296; E-6192) Avail: NTIS CSCL 18E

A new method is presented for producing neutrons in the keV energy region which utilizes gamma rays from the radioactive decay of a single isotope to induce the photoneutron reaction in beryllium. The neutrons have as many different energies as there are gamma ray energies above the 1.665-MeV threshold energy of this reaction. For the gamma ray emitters chosen, the neutrons were nearly monoenergetic, although sometimes bienergetic. The gamma ray emitters were steadily formed by neutron activation in an aqueous solution circulated through a nuclear reactor. After leaving an irradiation reservoir near the reactor core, the activated solution flowed over the exterior surface of a thin spherical shell of beryllium, where the photoneutrons were produced. Near the center of the shell, the neutron flux was nearly time-independent and isotropic; the effects of multiple scatterings by all materials were calculated by a one-dimensional multigroup transport code. In order to generate a variety of neutron spectra, the sulfates of manganese, indium, and aluminum were used in separate experiments. Fluxes of the order of 10,000 to 1,000,000 neutrons/sq cm sec can be obtained by this method. Author

N71-28141# Japan Atomic Energy Research Inst., Tokyo.
THERMAL CONDUCTIVITY OF VIPAC UO2 FUEL. 2: IN-PILE MEASUREMENT IN TLG-1
Eiji Shirai, Tanemichi Kitahara, Masao Fukushima, Katsuaki Kumagai, Hideo Murata et al Sep. 1970 37 p In JAPANESE; ENGLISH summary
(JAERI-4128) Avail: AEC Depository Libraries

Results of measurements of the thermal conductivity of vibratory compacted UO2 fuel in the temperature range from 200 to 1500 C are presented. The fuel was irradiated in an in-pile gas loop, TLG-1, of the JRR-2 reactor with a special capsule. The design of the capsule and its preliminary examination are described. From the difference between the temperatures at the coolant gas and the surface of the outer capsule, the rod power of the fuel was calculated and the thermal conductivity was determined. The thermal condictivity in the range up to 1500 C is represented by the emperical equation K = (1/27.8 + 0.021 T) where T is the temperature of the fuel (C). The thermal conductivity of the VIPAC UO2 at temperatures near 1400 C was shown to be similar to that of the sintered UO2 pellet. The post-irradiation examination of the capsule is also described. Author (NSA)

N71-28194# Oak Ridge National Lab., Tenn. Reactor Chemistry Div.
FIRST FUEL ROD FAILURE TRANSIENT TEST OF A ZIRCALOY-CLAD FUEL ROD CLUSTER IN TREAT Final Report
R. A. Lorenz, D. O. Hobson, and G. W. Parker Mar. 1971 83 p refs
(Contract W-7405-eng-26)
(ORNL-4635) Avail: NTIS

The first fuel rod failure experiment in Transient Reactor Test Facility (TREAT) was performed with a seven rod bundle of 27 in. long Zircaloy-clad UO2 fuel rods in flowing steam atmosphere. A water reactor loss-of-coolant accident was simulated by operating TREAT reactor at constant power for 20 sec so that fission heat in the UO2 pellets caused the Zircaloy cladding temperature to rise 72 F/sec to a maximum of approximately 1800 F. The fuel rods were initially pressurized with helium between 115 and 215 psia (77 F) to simulate accumulated fission gas. The Zircaloy cladding swelled and ruptured resulting in 48% blockage of the bundle coolant channel area at the location of maximum swelling. The average rod maximum circumferential swelling was 36%. Calculations related the hoop stress and ultimate strength at the onset of rapid expansion. The ideal gas law was used to calculate the rate of cladding expansion from measured rod temperature and internal pressure. Metallographic examination revealed ductile ruptures and significant oxygen pickup. Author (NSA)

N71-28215# Gulf General Atomic, San Diego, Calif.
EXAMINATION OF PEACH BOTTOM HTGR CONTROL ROD, CONTROL ROD GUIDE TUBE, AND THERMALLY RELEASED SHUTDOWN ROD CO8-01 AFTER 300 EFFECTIVE FULL POWER DAYS OF OPERATION
O. M. Stansfield Dec. 1970 74 p refs
(Contract AT(04-3)-314)
(GA-10196) Avail: NTIS

The control rod and control rod guide tube from position CO8-01 of the Peach Bottom high-temperature gas-cooled reactor were examined after 300 effective full power days of operation. The general condition of the control rod was essentially unchanged from the manufactured condition except for a discoloration of metallic parts, some embrittlement of Haynes 25 alloy disk springs, and axial shrinkage of the boronated graphite neutron absorbers. Changes in diametral dimensions were not great enough to exceed manufactured tolerances. The stresses and strains in the absorber walls were calculated. Satisfactory performance was predicted to full lifetime exposure. The guide tube showed few effects of the reactor exposure. The major deviations from the manufactured condition were a cracked thermally released shutdown absorber support and an axial bow of about 0.122 in. in the guide tube bow suggested an accelerated shrinkage on the surface facing the core outside diameter. The release temperature of the thermally released shutdown rod was measured and found to be 1740 + or - 5 F and apparently unchanged by the reactor exposure. Author (NSA)

N71-28310# European Atomic Energy Community, Luxembourg.
THERMAL CONDUCTIVITY OF URANIUM DIOXIDE [CONDUCTIBILITE THERMIQUE DU BIOXYDE D'URANIUM]
H. Marchandise Nov. 1970 158 p refs In FRENCH
(EUR-4568) Avail: AEC Depository Libraries

The main available data are collected on the thermal conductivity of UO2 in pile and out of pile, on the conductivity integral, and on their variations under the influence of such parameters as stoichiometry and porosity. Both sintered and vibro-compacted fuels are considered. The conductivity integral (from 500 to 2,800 C) of pellet UO2 fuels (95% td) seemed to be about 68 + or - 5 W/cm. Vibro-compacted fuels, 85% td had only half of this value under fast heating conditions. After redistribution of UO2 at high temperatures, the conductivity integral of compacted fuels could approach 59 W/cm. Author (NSA)

N71-28564# European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.
EFFECT OF VARIOUS IMPURITIES ON THE ELECTRICAL CONDUCTIVITY OF ORGANIC COOLANT LIQUIDS
D. Van Velzen, H. Langenkamp, and G. Serrini 28 Oct. 1970 24 p refs
(EUR-4597-E) Avail: AEC Depository Libraries: EUR F. Fr. 14.45

The effect of various impurities in the ppM range on the electric conductivity of organic coolant liquids was investigated. The experiments were carried out in a small versatile loop. The analytical equipment for operation in the MK-5 loop of the ESSOR reactor was tested. It appears that it is not possible to use the electric conductivity as a measure of the total chlorine content, since insufficiently dissociated compounds do not influence the electric conductivity. Most probably, these compounds are not very active as fouling promotors. Continuous recording of the electric conductivity in high-purity organic coolants is a useful operation, since any increase of the conductivity is caused by an increase of the impurity content. Author (NSA)

N71-28569# Argonne National Lab., Ill.
REACTOR DEVELOPMENT PROGRAM Progress Report, Jan. 1971
19 Feb. 1971 135 p refs
(Contract W-31-109-eng-38)
(ANL-7776) Avail: NTIS

Highlights of project activities for January 1971 are summarized. The LMFBR physics and component development studies are reviewed. Operations and analysis of ZPR-6, ZPR-9, and ZPPR are described. The EBR-2 research and development projects, fuel fabrication, and maintenance during shutdown are summarized. Reactor fuels and materials development, physics studies, engineering development, fuel cycle chemistry, LMFBR safety studies, and engineered safeguards analyses are reported. NSA

N71-28588# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
REACTOR SHIELDING IN THE COMMISSARIAT a l'ENERGIE ATOMIQUE
C. Devillers, P. Lafore, and J. Rastoin [1970] 25 p refs Presented at the Joint ENA/IAEA Meeting on The Phys. Probl. of Reactor Shielding, Paris, 8 Dec. 1970
(CEA-CONF-1730; CONF-701208-1) Avail: AEC Depository Libraries

Semiempirical calculations on reactor protection were

abandoned, and the Monte Carlo method used instead. The method of discrete ordinates and the Monte Carlo method are described. Examples using the calculations are given: calculation of the neutron flux in the thermal column of the Harmonie Source Reactor, three dimensional Monte Carlo calculations on the neutron current in the vicinity of heat exchangers of Phenix and calculations of the neutron flux in the iron column of the Harmonie Source Reactor. The problem of evaluating cross sections is analyzed. The nuclear codes used are enumerated. NSA

N71-28590# European Atomic Energy Commuhity, Ispra (Italy). Joint Nuclear Research Center.

THERMO-HYDRODYNAMIC MODEL FOR THE THEORETICAL STUDY OF THE BOILING AND EJECTION OF THE COOLANT FROM A REACTOR CHANNEL DUE TO A DIRECT CONTACT WITH HOT MOLTEN FUEL

J. Randles 21 Oct. 1970 42 p refs
(EUR-4592-e) Avail: AEC Depository Libraries

On the basis of a simplified respresentation of a reactor channel containing a region where hot molten fuel becomes mixed with the coolant, the equations of heat transfer and balance are derived in a form which permits the evaluation of the pressure and vapor mass generated by the boiling of the coolant. These equations are then coupled, via the pressure and vapor mass, to the equation of motion describing the ejection of the unboiled coolant from the channel. A simple numerical method of solving the complete set of equations jointly has been embodied in a new computer program TOMOF (thermohydrodynamics of a mixture of two fluids). This programme has been tested with a wide range of data and has proved that the chosen numerical method is effective. In particular, in order to provide a preliminary idea of the results to be expected, the TOMOF programme has been applied to the proposed Ispra UO2/Na direct contact rig. Author (NSA)

N71-28591# Battelle-Northwest, Richland, Wash.

ISODIL: A COMPUTER CODE FOR PROCESSING ISOTOPIC DILUTION MEASUREMENTS FROM SPENT FUEL SAMPLES

R. P. Matsen Jan. 1971 61 p refs
(Contract AT(45-1)-1830)
(BNWL-1555) Avail: NTIS

The ISODIL code processes data from isotopic dilution measurements from an irradiated fuel sample into information descriptive of the nuclear transformations that have occurred within the sample. The code analyzes data from either plutonium or uranium–plutonium fuel samples. In addition to printed output, other output features include plots of the measured data and punched cards for input to the DBUFIT least squares burnup code, which is used to obtain cross section information from the data. Equations used in the code are described and use of the code is illustrated with several sample cases. Author (NSA)

N71-28621# Atomics International, Canoga Park, Calif.

LMFBR PHYSICS PROGRAMS Quarterly Technical Progress Report, Oct.–Dec. 1970

15 Feb. 1971 39 p
(Contract AT(04-3)-701)
(AI-AEC-12985) Avail: NTIS

Theoretical and experimental reactor research is reported. Fast breeder reactor physics studies centered on a review of Doppler measurements showing that a direct experimental comparison of data resulting from different assemblies could be systematically carried out. It was also found that the Doppler effect at high temperatures can be predicted and that good agreement between calculation and experiment on tantalum control can be achieved. A calculational method was developed to treat self-shielding of unresolved resonances in a Monte Carlo calculation without increasing computation time or straining the high speed memory capacity of present generation computers. Computer codes were developed for processing and evaluating of neutron cross section data. N.E.N.

N71-28625# Gulf Radiation Technology, San Diego, Calif.

APPLICATION OF PHOTOINDUCED REACTIONS TO NUCLEAR MATERIALS SAFEGUARDS PROBLEMS Quarterly Progress Report, 1 Jul.–30 Sep. 1970

R. L. Bramblett, R. O. Ginaven, T. Gozani, A. T. Hyde, J. I. McMillan et al 23 Dec. 1970 65 p refs
(Contract AT(04-3)-167)
(Gulf-RT-10459) Avail: NTIS

Development of techniques and hardware for the quantitative assay of nuclear materials is described. The techniques are for application to problems in the nuclear reactor fuel cycle, particularly for measurements that cannot be performed by wet chemistry. The approach is based on the use of photonuclear reactions initiated by an electron linear accelerator, Linac, and resulting in characteristic responses from nuclear materials in samples of arbitrary geometry. Application of these nondestructive measurements to presently unmeasured items in the fuel cycle will improve the control of nuclear materials that is required in safeguarding against diversion. To attain the earliest possible application to problems in the nuclear fuel industry, a field testing program was initiated. A transportable Linac was designed to meet the requirements for field operation. The Linac and other equipment, including a barrel scanner and an on-line computer, were installed into a conventional instrumentation trailer to form a transportable nuclear materials assay system (GAMAS). Author (NSA)

N71-28640# WADCO Corp., Richland, Wash. Hanford Engineering Development Lab.

PREPARATION OF IRRADIATED LIQUID METAL FAST BREEDER REACTOR (LMFBR) PROTOTYPIC FUELS FOR METALLOGRAPHY

W. J. Gruber [1969] 16 p refs Presented at the 3d Meeting of the Intern. Metallog. Soc., Cleveland, 16–19 Nov. 1970
(Contract AT(45-1)-2170)
(WHAN-SA-14; CONF-701118-1) Avail: NTIS

Irradiated, fast reactor, prototypic, mixed oxide, and cermet fuel components were sampled and prepared in remote facilities for metallographic examinations. Metallography, shielded electron microprobe studies, conventional and scanning electron microscopy from replicas, microsampling, and autoradiography were routinely employed to obtain post-irradiation data. Various sampling and preparation techniques were adapted or developed for these examinations. The selection and sequencing of preparation techniques are based on fuel type, examination requirements, and irradiation history. Author (NSA) n

N71-28641# Sandia Corp., Albuquerque, N.Mex.

HUGONIOT RELATIONSHIP FOR A HIGH DENSITY, DISTENDED CERMET (THORIA-MOLYBDENUM)

R. P. May Feb. 1971 19 p refs
(SC-DR-70-908) Avail: NTIS

Hugoniot data are presented for the cermet to a material velocity of 0.262 mm/microsec. This resulted in a maximum stress of 110 kilobars. An elastic wave was measured at a velocity of 5.22 mm/microsec and nominal stress of 12 kilobars. The material studied was distended with an initial porosity of four percent. By using a theoretical solid density of 10.022 g/cu cm and assuming that the solid was linearly elastic to the maximum stress of this study, it was found possible to fit the data to the porous (p–alpha) model of Herrmann. Author

N71-28642# General Electric Co., San Jose, Calif. Reactor Fuels and Reprocessing Dept.

PLUTONIUM UTILIZATION IN BOILING WATER REACTORS, PHASE 2 Semiannual Report, Jan.–Jun. 1970

G. L. O'Neill, comp. Sep. 1970 44 p ref Sponsored by AEC Prepared for Edison Elec. Inst., New York
(NEDC-12152) Avail: NTIS

Irradiations and pool examinations for 32 PuO2 – UO2 fuel rods; fabrication, installation, and initial irradiation in Big Rock Point for three PuO2 – UO2 fuel bundles; and design and preliminary safeguards work for four Vermont Yankee PuO2 – UO2 bundle prototypes are reported. Plutonium recycle design optimization and economic studies are discussed and an interim reference design selected for boiling water reactor recycle of plutonium. Author (NSA)

N71-28843# Oak Ridge National Lab., Tenn.
CALCULATED NUCLEAR AND ECONOMIC PERFORMANCE OF NIOBIUM AND MOLYBDENUM IN LMFBR CORES
L. L. Bennett, W. E. Thomas, and F. J. Homan 12 Feb. 1971 41 p refs
(Contract W-7405-eng-26)
(ORNL-TM-3271) Avail: NTIS

A study of the effect on LMFBR nuclear and economic performance resulting from use of niobium and molybdenum as cladding and/or fuel element structural materials is described. The work reported places primary emphasis on the economic aspects, especially the relative fabrication costs with different materials, and provides economic results needed for a complete evaluation of the relative merit of the selected refractory metals. Author (NSA)

N71-28876# Nuclear Materials and Equipment Corp., Leechburg, Pa. Plutonium Lab.
FABRICATION OF 20 w/o PuO2-UO2 FAST BREEDER FUELS FOR IRRADIATION TESTING IN EBR-2
Jun. 1970 67 p
(Contract AT(30-1)-3524)
(NUMEC-3524-74) Avail: NTIS

Work performed under Task 1 of the program as related to the fabrication and characterization of Series A, B, and C fuel rods for irradiation testing in EBR-II and the corresponding archive rods, designated as Series D is summarized. NSA

N71-28886# Oak Ridge National Lab., Tenn.
HIGH FLUX ISOTOPE REACTOR Quarterly Report, Oct. – Dec. 1970
R. V. McCord and B. L. Corbett 9 Mar. 1971 26 p Sponsored by AEC
(ORNL-TM-3339) Avail: NTIS

Control-plate-bearing problems recurred and reduced the reactor operating time to 83.1% which resulted in an operating time for calendar 1970 of 88%. Two of the redesigned controlplate bearings, which were expected to last for more than 15 fuel cycles, broke during their fifth cycle of operation. Debris from the broken bearings caused additional rod-drive problems during precritical control-plate tests. Installation of a set of reworked control plates resulted in the incomplete insertion of a safety plate during a reactor scram. The primary water leak at the HB-1 Marman flange increased to 1.5 gpm but seemed to stabilize at that point. Author (NSA)

N71-28887# Institutt for Atomenergie, Halden (Norway). OECD Halden Reaktor Prosjekt.
UKAEA FUEL TEST ASSEMBLIES IRRADIATED IN HBWR, 1964 – 1968
D. G. Bridge, D. Cordell, D. M. Evans, A. Garlick, A. L. Greenwood et al 5 Feb. 1970 147 p refs
(HPR-132; TRG-1804) Avail: AEC Depository Libraries

Irradiation experiments in the Halden BWR on eleven UKAEA fuel test assemblies are described and the results of post-irradiation examination on six of the assemblies are reported. Author (NSA)

N71-28888# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Reaktorentwicklung.
SAFETY REPORT FOR FR-2 INSERTED CAPSULE EXPERIMENTS WITH SEVERAL NaK CAPSULES FOR IRRADIATION OF HIGH-CONDUCTIVITY FUEL ELEMENTS [SICHERHEITSBERICHT FUER FR2-KAPSELVERSUCHSEINSAETZE MIT EINWANDIGEN NAK-KAPSELN ZUR BESTRAHLUNG VON HOCHLEISTUNGSBRENNSTAESEN]
H. Haefner Jan. 1970 82 p refs In GERMAN; ENGLISH summary
(KFK-1143) Avail: AEC Depository Libraries

Irradiation of U/Pu mixed carbide fuel pins of lengths up to 1 m is scheduled. At the initial stage, pins of 475 mm length (300 mm fuel length and 10 mm outer diameter of the cladding tube) will be introduced including pins with He and Ar bonding as well as with Na bonding. The central fuel temperature (2,000 C max.) will be measured in the case of fuel pins with gas bonding. Maximum pin power is intended to be 1,150 W/cm for a temperature of the cladding tube surface of 630 C; for the time being, the burnup is limited to 50,000 MWd/te of fuel. A capsule for a high pin power was developed using NaK as heat transfer medium which surrounds the fuel pin. The separation between NaK and the reactor cooling water is achieved by only one wall which consists of a capsule tube of niobium-1% zirconium. An intermediate tube with good thermal conductivity is fitted into the NaK gap in order to achieve lower heat flux densities on the capsule surfaces and to avoid convection in the NaK. In addition to the description of the capsule rigs and their operational behavior, the actual safety considerations which play a particularly important part because of the possible risks of NaK/water reactions resulting from a leak in the capsule are also discussed. Author (NSA)

N71-28889# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
DETECTION OF LOCAL BOILING IN LIGHT WATER REACTORS [ETUDE PORTANT SUR LA DETECTION DE L'EBULLITION LOCALE DANS LES REACTEURS A EAU LEGERE]
Marcel Deiss and Pierre Janot Jan. 1971 51 p refs In FRENCH
(CEA-R-4118) Avail: AEC Depository Libraries

The characteristics of local boiling in the Silouette reactor was studied. The influence of various parameters was examined to define a simple criterion characteristic of the phenomenum. Two methods of detection are described: detection by correlation with neutron noise, and the attenuation of an acoustic or ultrasonic signal in traversing a layer of bubbles. Author (NSA)

N71-28700 Iowa State Univ. of Science and Technology, Ames.
INVESTIGATION OF AN AUXILIARY DISCHARGE THERMIONIC CONVERTER USING BARIUM OXIDE ELECTRODES
Paiboon Limpaphayom (Ph.D. Thesis) 1969 94 p
Avail: Univ. Microfilms Order No. 70-13806

The design, fabrication, and terminal characteristics of several auxiliary discharge thermionic energy converters are described. The converters used a Penning mixture as a filling gas, contained oxide coated electrodes, and were operated in the range 1100 to 1400 K. Experiments were performed to determine the effect of varying system parameters such as electrode spacing, operating temperature, pressure of filling gas, and collector cooling upon cost of space charge neutralization. Decomposition and activation of electrode coatings, crucial in the operation of the converters, are treated in detail. Dissert. Abstr.

N71-28723# WADCO Corp., Richland, Wash. Hanford Engineering Development Lab.
PROGRESS IN MEETING CROSS SECTION NEEDS FROM A FAST REACTOR DESIGNER'S VIEW

W. W. Little, R. W. Hardie, and L. D. O'Dell [1970] 14 p refs Presented at the 3d Conf. on Neutron Cross Sections and Technol., Knoxville, Tenn., 15–17 Mar. 1971
(Contract AT(45-1)-2170)
(HEDL-SA-163; Conf-710301-1) Avail: NTIS

An outline is given of the cross section requirements for the design and operation of fast breeder reactors. Progress toward meeting these requirements is assessed by comparing calculated and experimental results from recent plutonium fueled fast critical assemblies. The results of selected sensitivity studies are given to permit the demands on integral reactor quantities to be translated into demands on individual cross sections. Author (NSA)

N71-28724# Westinghouse Electric Corp., Madison, Pa. Advanced Reactors Div.
CARBON EQUILIBRIUM LOOP CONTINUATION Sodium Technology Program Progress Report, Period Ending 30 Nov. 1970
William E. Ray Jan. 1971 51 p refs
(Contract AT(30-1)-4210) (WARD-4210-T-1-1) Avail: NTIS

Research results are reported for a program directed toward determining the rates and direction of C and N transfer in structural materials used with high-temperature sodium. Information is included on design, construction, and operation of carbon equilibrium loops, electrochemical carbon meter design and operation, cover gas analysis, determination of oxygen in sodium, and models of mass transfer in sodium. NSA

N71-28725# United Kingdom Atomic Energy Authority, Risley (England). Authority Health and Safety Branch.
APPRECIATION OF FAST REACTOR SAFETY, 1970
1970 200 p refs
(NP-18487) Avail: AEC Depository Libraries

Various aspects of sodium-cooled fast reactors which affect their potential safety are discussed. Separate chapters review problems in: (1) kinetic behavior; (2) cooling failure in a subassembly; (3) excursion behavior; (4) molten fuel; (5) evaluation of containment explosion potential; (6) containment; (7) decay heat rejection; (8) sodium-water reactions; (9) instrumentation; (10) fire hazards and precautions; (11) fuel handling; and (12) fission product behavior in sodium. NSA

N71-28738# Bettis Atomic Power Lab., Pittsburgh, Pa.
PORE MOTION IN SOLIDS RESULTING FROM APPLIED STRESSES (LWBR DEVELOPMENT PROGRAM)
S. H. Leiden and M. J. Trinko Feb. 1971 22 p refs
(Contract AT(11-1)-GEN-14)
(WAPD-TM-983) Avail: NTIS

Stress induced pore migration within the fuel elements of atomic reactors is considered. A computer oriented analysis was undertaken in an attempt to fix the sign and magnitude of the response of a pore to a stress field. It was verified that two bubbles will always attract as long as one contains some uncompensated pressure. Further, a bubble containing uncompensated pressure will be attracted to a free surface and repelled from a clamped surface. Finally, it is shown that a void placed in a linear uniaxial stress gradient will move up the gradient, no matter whether the gradient is produced by external tension or compression. Numerical estimates are made for the size of expected forces on real sized bubbles. Author (NSA)

N71-28743# Battelle Memorial Inst., Columbus, Ohio.
COMPATIBILITY OF NITRIDE REACTOR FUELS WITH AUSTENITIC STAINLESS STEELS
John C. Hebeisen, Donald P. Moak, and William H. Pfeifer Jan. 1971 32 p refs
(Contract W-7405-eng-92)
(BMI-1895) Avail: NTIS

The compatibility of UN and (U,Pu)N fuels with austenitic stainless steel cladding under simulated liquid metal fast breeder reactor (LMFBR) conditions was evaluated using compatibility couples heated in both sodium bonded and pressure contacted capsules for times from 1,000 to 10,000 hr at temperatures from 700 to 1000 C. Stoichiometric mononitride fuels were compatible with austenitic stainless steel claddings for at least 10,000 hrs at 700 C and 1,000 hrs at 1000 C. However, several factors had an adverse effect on the compatibility. Oxygen contained in the cladding or capsule environment readily reacted with the fuel to release nitrogen; the nitrogen so formed diffused into the claddings, with the formation of nitride precipitates. Nonstoichiometric fuels also reacted with the stainless steels. Author (NSA)

N71-28763# Babcock and Wilcox Co., Lynchburg, Va. Research and Development Div.
PHYSICS VERIFICATION PROGRAM, PART 3, TASK 4 Summary Report
M. N. Baldwin, M. E. Stern Mar. 1971 39 p refs
(Contract AT(30-1)-3647)
(BAW-3647-20) Avail: NTIS

A series of experiments to measure the effects of lattice heterogeneities on reactor physics parameters are reported. The facility used was a water moderated critical assembly in a 5 by 6.5 foot aluminum tank. Poison, neutral, and moderating materials were used to produce heterogeneities for study. The facility and experiments are described and the measurement results are presented. NSA

N71-28755# Atomic Power Development Associates, Inc., Detroit, Mich.
LOOP EVALUATION OF THE APDA IN-LINE DETECTOR FOR HYDROGEN IN SODIUM
J. A. Coleman Jun. 1970 115 p refs
(Contract AT(11-1)-865)
(APDA-252) Avail: NTIS

The nickel palladium catalytic hydrogen detector, based on the principle of catalytic oxidation of hydrogen to water, was evaluated in a dynamic system in the sodium technology loop. The detector was demonstrated to be a reliable, accurate, and sensitive means of monitoring the hydrogen concentration of a flowing sodium system. The linearity of response was demonstrated up to 3 ppM hydrogen; the sensitivity for a change in hydrogen concentration was 0.018 ppM. During the 4,000 hours of testing, no degradation of performance was observed. In addition to the stable performance of the detector coil, the sodium temperature control system, sweep gas system, hydrogen injector, and moisture monitor performed well. Author (NSA)

N71-28756# Ceskoslovenska Akademie Ved, Rez. Ustav Jaderneho Vyzkumu.
A STUDY OF THE CONTROL SYSTEM OF A MATERIALS TESTING REACTOR
P. Kovanic and J. Rygl [1970] 33 p In CZECH
(UJV-2375-RPA) Avail: AEC Depository Libraries

Three conception variants were worked out for the control system of a materials testing reactor, based on the utilization of movable detectors. The first variant uses an analog type technique for the treatment of impulses from neutron detectors, the second uses a set of three special purpose digital computers, and the third employs three independent minicomputers of a universal type. Owing to the use of movable neutron detectors, all three versions meet the actual requirements for system reliability and reactor safety. Author (NSA)

N71-28757# Rensselaer Polytechnic Inst., Troy, N.Y. Dept. of Nuclear Science.
IMPROVEMENTS TO SLOWING DOWN THEORY FOR FAST

REACTORS
Floyd E. Dunn and Martin Becker 1970 62 p refs
(Contract AT(30-1)-328)
(RPI-328-217) Avail: NTIS

Continuous slowing down theory has proved to be useful in problems associated with thermal reactors. The treatment of inelastic scattering and of scattering and absorption resonances in a mixture of several moderating materials is considered. New methods are advanced for each of these problem areas. These methods are shown to lead to a continuous slowing down model of reasonable accuracy for fast reactor problems. The inelastic treatment is based on matching the solution for an easily solvable reference problem. The mixture treatments are based on averaging procedures over a scattering interval instead of at a single energy. Author (NSA)

N71-28758# Los Alamos Scientific Lab., N.Mex.
MASKED EDDY CURRENT PROBE FOR DETECTION OF ROVER FUEL ELEMENT COATING CRACKS
R. M. Ford and R. D. Strong Jan. 1971 5 p refs
(Contract W-7405-eng-36)
(LA-4590) Avail: NTIS

A masked probe has been designed to provide eddy current inspection of the protective coating quality on Rover fuel elements. The probe design and electronic circuitry for the inspection equipment are described. Typical results of inspections are shown and discussed. Author (NSA)

N71-28759* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
GAS CORE NUCLEAR REACTOR Patent
Frank E. Rom, inventor (to NASA) Issued 27 May 1968 4 p
Filed 27 May 1968 Cl. 176-45; Int. Cl. G21c3/56, 19/28
(NASA-Case-LEW-10250-1; US-Patent-3,574,057;
US-Patent-Appl-SN-732455) Avail: US Patent Office CSCL 18I

A gas passes through a pervious liner into a gaseous core nuclear reactor. This gas cools the liner and is then heated by a fissionable gas in the core. The heated gas is discharged from the reactor. Official Gazette of the U.S. Patent Office

N71-28760# California Univ., Berkeley. Lawrence Radiation Lab.
PARTITION OF NUMBERS AND APPLICATION TO HIGHER DERIVATIVES OF COMPOSITE FUNCTIONS
Jorma T. Routti and Andreas Szalay 30 Sep. 1970 12 p refs
(Contract W-7405-eng-48)
(UCRL-20215) Avail: NTIS

Formulae and algorithms are presented for computing the partitions and the number of partitions of positive integers. Results are given and applied through an equivalent form of the partition problem to the determination of higher derivatives of composite functions, in particular to the probability generating functions in reactor noise analysis. Author (NSA)

N71-28761# United Kingdom Atomic Energy Authority, Harwell (England).
CALCULATION OF STRESS IN FAST REACTOR FUEL ELEMENTS
J. R. Matthews Sep. 1970 22 p refs
(AERE-R-6516) Avail: AEC Depository Libraries

Estimates of the stresses generated by the restraint of a swelling fuel by its cladding and from other sources are necessary to predict lifetimes of existing fuel element designs and to optimize new configurations. Mathematical models have been developed to enable uniaxial creep and swelling data of both fuel and cladding materials to be used in the calculation of the mechanical behavior of cylindrical fast reactor fuel elements. These models are applied to a hypothetical fast reactor fuel element. The variables of fuel power density, clad temperature, clad creep properties and fuel element dimension are examined and their effects on fuel element stresses calculated. Author (NSA)

N71-28785 National Lending Library for Science and Technology, Boston Spa (England).
MECHANICAL PROPERTIES OF IRRADIATED URANIUM
M. A. Vorbiev et al 30 Jul. 1970 11 p refs Transl. into ENGLISH from Atomnaya Energ. (Moscow), v. 28, no. 2, Feb. 1970 p 107–110 In ENGLISH and RUSSIAN
(NLL-Windscale-Tran-432-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Tensile, compression, fatigue tests were conducted on samples of irradiated and nonirradiated uranium fuel elements to determine their mechanical properties. The results confirm that with increasing burnup the tensile strength drops for all irradiation temperatures. For comparable burnup, there is a sharper drop in strength for samples irradiated at 250 to 350 C. The fatigue and compression test data are in general agreement with these findings. Comparisons of test results on monocrystalline and polycrystalline uranium show that reductions in strength and plasticity are caused mainly by phenomena occurring at the grain boundaries. It was concluded that the range of maximum weakening of uranium during irradiation does not coincide with the range of maximum dynamic loading of the fuel element. The reason for the reduced strength and plasticity of the irradiated uranium is evidently to be found in the form of grain boundary defects comprising microcracks and vacancy micropores, 0.01 microns in size, which are formed as a result of the interaction of differently orientated grains during irradiation. M.G.J.

N71-28786# Argonne National Lab., Idaho Falls, Idaho.
TRANSFORMATION KINETICS OF U-5 wt PERCENT Fs DRIVER FUEL PINS PRODUCED BY AEROJET GENERAL CORPORATION
A. K. Chakraborty Nov. 1970 38 p refs
(Contract W-31-109-eng-38)
(ANL-EBR-32) Avail: NTIS

The U–5 wt % Fs fuel pins in driver elements shortened during irradiation. The shortening was caused by stresses on the fuel during the centrifugal bonding, which led to a texture responsible for the axial shortening. This unwanted texture, however, could be removed by subsequent heat-treating; this procedure is being used to salvage the centrifugally bonded fuel. To help determine the most effective annealing cycle, the transformation kinetics of as-cast and as-bonded pins were studied by relating annealing time to hardness, density, electrical resistivity, microstructure, and diffraction patterns of the fuel. The results showed that: as-cast fuel would be transformed to the alpha + delta + U2Ru phases by annealing 40 min at 500 C; as-bonded fuel would be transformed to the gamma + U2Ru phases by annealing 30 min at 660 C; as-bonded fuel heat-treated at 660 C for 2 hr would be transformed to the alpha + delta + U2Ru phases by annealing 40 min at 500 C. Author (NSA)

N71-28800# Ceskoslovenska Akademie Ved, Raz. Ustav Jaderneho Vyzkumu.
USE OF MULTIGROUP DIFFUSION CONSTANTS FOR A PHYSICS CALCULATION OF THE ZRR EXPERIMENTAL FAST REACTOR
I. Tinka 1970 16 p refs In SLOVAK
(UJV-2408-RF) Avail: AEC Depository Libraries

A series of check calculations in the multigroup one-dimensional approximation was performed to determine the effect of some factors on the fundamental characteristics of a reactor. The results of a physics calculation for the ZRR experimental fast reactor were employed. The effect of the resonance self-shielding coefficient and the method for reducing the number of groups are analyzed, and the six-group microconstants used in the calculations are given. Author (NSA)

N71-28820*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
NUCLEAR DESIGN AND EXPERIMENTS FOR A SPACE

POWER REACTOR

Wendell Mayo, Paul G. Klann, and Charles L. Whitmarsh, Jr. 1971 21 p refs Presented at the Am. Nucl. Soc. Meeting, Boston, 13–17 Jun. 1971

(NASA-TM-X-67857; E-6362) Avail: NTIS CSCL 18I

A technology program is being conducted in support of a compact fast spectrum reactor to be used as a heat source for generating electric power in space. To provide a focal point, a reference reactor was chosen and performance goals established. The reactor is to operate at a thermal power level of 2 megawatts for 50,000 hours with a lithium 7 coolant outlet temperature of 1222 K and would provide about 500 kilowatts of electric power from a Brayton cycle power conversion system. Details of mechanical design, thermal and hydraulic aspects, fuel swelling, and reactor dynamics for this reference reactor are discussed. Materials compatibility and irradiation experiments reactor are also included and alternate reactor designs are considered. Author

N71-28821*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

HIGH SPEED IMPACT TESTS OF A MODEL NUCLEAR REACTOR CONTAINMENT SYSTEM

R. L. Puthoff 1971 19 p refs Presented at the Am. Nucl. Soc. Natl. Meeting, Boston, 13–17 Jun. 1971

(NASA-TM-X-67856; E-6361) Avail: NTIS CSCL 18E

Five impact tests were conducted on models of reactor containment systems. These models mockup the impact energy absorbing characteristics of the reactor, shield, and containment vessel. The reactor was stimulated by a 12 inch solid steel ball. The gamma shielding was simulated by steel saddles and the neutron shielding was simulated by either water or wood (simulating LiH). The stainless steel containment vessel was 2 feet in diameter. The models weighed from 350 lbs to 1305 lbs. Their impact velocities varied from 241 to 580 ft/sec. Impact occurred against a 15,000 lb reinforced concrete block. Results of the tests are as follows: No leaks were detected nor cracks observed on any of the models. Even though the deformation (expressed as a function of sphere radius) of the 2 foot diameter hollow sphere was slightly higher than predicted the test did verify that the deformations are not significantly affected by vessel diameter. Author

N71-28905*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

CONCEPTUAL DESIGN OF A COMPACT FAST REACTOR FOR SPACE POWER

Morton H. Krasner, Harry W. Davison, and Anthony J. Diaguila 1971 24 p refs Presented at the Am. Nucl. Soc. Natl. Meeting, Boston, 13–17 Jun. 1971

(NASA-TM-X-67859; E-6379) Avail: NTIS CSCL 18I

The reference design contains 247, 1.90 cm diameter, fuel pins with a fuel length of 37.6 cm. The fuel elements were designed for < 1 percent diametral growth using applicable analytical techniques. Salient features of the design shown include stationary core fuel elements, 6 rotating drums containing fuel, molybdenum alloy reflectors, and a honeycomb fuel element support structure. The reactor performance goals include life - 50,000 hours, coolant outlet temperature - 1220 K, and thermal power approximately 2 Mw. Ceramic UN is the primary fuel candidate (UO2 and UC were considered) because of high uranium content, thermal conductivity, and melting point. Lithium coolant was chosen because of superior heat transfer characteristics and high temperature potential. Tantalum alloy, T-111, is a strong ductile and relatively easily fabricable refractory which is the reference structural material with Nb-1Zr as back-up. Moving fuel is the preferred method for controlling the reactor. Author

N71-28913*# Techtran Corp., Glen Burnie, Md.

INSTITUTE FOR NUCLEAR ENERGY, UNIVERSITY OF STUTTGART Annual Report, 1970

Washington NASA Jun. 1971 46 p refs Transl. into ENGLISH from German report

(Contract NASw-2037)

(NASA-TT-F-13687) Avail: NTIS CSCL 18I

Research activities of INE during the reporting period are reported. Topics discussed include: financial report, nuclear data, neutron physics, and radiation shielding. Lists of doctoral theses completed during this period are also included. F.O.S.

N71-28939*# Scientific Translation Service, Santa Barbara, Calif.

OPTIMIZATION OF THE CELL DIMENSIONAL PARAMETERS OF AN INCORE THERMIONIC FUEL ELEMENT [OPTIMIERUNG DER ZELLABMESSUNGEN IM BRENNELEMENT EINES INCORE-THERMIONIKREAKTORS]

E. Wolf et al Washington NASA Jun. 1971 16 p refs Transl. into ENGLISH from Atomkernenergie (Munich), v. 16, 1970 p 213–218

(Contract NASw-2035)

(NASA-TT-F-13689) Avail: NTIS CSCL 18J

Performance data of incore thermionic fuel elements with series-connected converters are determined by means of a theoretical model in a wide range of operational and geometrical parameters and used to optimize several of such parameters. In general, the single cells are differently heated in the reactor core. The effect of this nonuniform heat generation on the total output data is investigated. A method for power enhancement by means of variation of converter lengths or interconnection lead geometries in the fuel elements is discussed. Author

N71-28940*# Scientific Translation Service, Santa Barbara, Calif.

RESULTS OF STUDIES OF THERMIONIC REACTOR SYSTEMS [ERGEBNISSE VON STUDIEN UEBER THERMIONIKREAKTOR-SYSTEME]

R. Pruschek et al Washington NASA Jun. 1971 36 p refs Transl. into ENGLISH from Raumfahrtforschung (Stuttgart), no. 4, 1968 p 169–179

(Contract NASw-2035)

(NASA-TT-F-13690) Avail: NTIS CSCL 18N

The results of various studies on five different thermionic reactor systems are reported. Information is given on characteristic data of these devices such as the amount of fissionable material, power output, specific power, mass of components, total mass, etc. Problems of power flattening, long time behavior, integration of converters to the nuclear heat source as well as specific design features are discussed for the following types of thermionic reactors: thermal incore thermionic reactor, thermal double diode thermionic reactor, fast incore thermionic reactor, fast heat pipe thermionic reactor, and fast thermionic reactor, emitter heated by heat radiation. Author

N71-28987*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

COMPACT 30 kw CIRCULATING HELIUM CAPSULE FOR FUEL ELEMENTS TESTS IN NASA PLUM BROOK REACTOR

G. E. McDonald, H. A. Putre, M. C. Swanson, P. M. Finnegan, and L. Homyak 11 Sep. 1969 14 p Presented at Natl. Symp. on Develop. in Irradiation Testing Technol., Sandusky, Ohio, 9–11 Sep. 1969; sponsored in part by AEC

(NASA-TM-X-52676; E-5283) Avail: NTIS CSCL 18I

A capsule was endurance tested out of pile and two capsules were run in the Plum Brook Reactor. The capsule operated at pressures to 2500 psi, motor speed to 3000 rpm, flow rates to 0.09 lb He/sec, capsule wall temperatures to 1000 F, specimen powers to 30 kw with 180 F cooling water. The demonstrated out-of-pile life was at least 3000 hours. Fuel specimen surface heat fluxes of 2 kw/sq in. were obtained in pile. The capsule was 18 feet long with 4.3 inch maximum o.d. and 2.875 o.d. in the test section. It was composed of a variable speed electric motor driven vane pump, concentric tube heat exchanger, and a fuel element test section. The capsule was made of modified commercially available

parts. Provisions were made for 15 thermocouples. Pressure leads used for filling were also used to measure gas flow rate and monitor coolant gas for fission product leaks. A loss of coolant accident could contained without reactor scram for specimen powers of 30 kw or less. The capsules were relatively inexpensive and could be discarded when the test was completed. Author

N71-28968*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MEASURED AND CALCULATED FAST NEUTRON SPECTRA IN A LEAD-AND-WATER SHIELDED REACTOR
Gerald P. Lahti and Gilbert N. Wrights 1971 22 p refs Presented at the Am. Nucl. Soc. Natl. Meeting, Boston, 13–17 Jun. 1971
(NASA-TM-X-67861; E-6394) Avail: NTIS CSCL 18I

Measurements of absolute neutron flux spectra were made in a layered cylindrical shield arrangement surrounding a small (25.4 cm diam) cylindrical UO2F2 - water solution reactor. The shield consisted of 91.4 cm high cylindrical shells of lead and water and extended to an outer radius of 122 cm. Measurements were made within the shield to depths into the shield of up to 100 cm with a 4.65 cm diameter by 4.38 cm high NE-213 liquid scintillator immersed in the water regions of the shield. The midplane of the detector was located along the midplane of the reactor. Calculations of absolute neutron flux spectra for this geometry were made using the one-dimensional discrete ordinates code ANISN and two-dimensional discrete ordinates code DOT. Preliminary calculations were made with ANISN to compare the adequacy of a coarse energy group split that was used in subsequent ANISN and DOT calculations. Comparison of these two calculations showed the depths in the shield at which ANISN and DOT results diverged as a result of transverse leakage approximations in ANISN. This point occurred at a radius of approximately 50 cm. Beyond this depth more confidence was placed in the DOT - calculated spectra. Author

N71-28969*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MATERIALS TECHNOLOGY PROGRAM FOR A COMPACT FAST REACTOR FOR SPACE POWER
R. E. Gluyas and A. F. Lietzke 17 Jun. 1971 27 p refs Presented at the Am. Nucl. Soc. Natl. Meeting, Boston, 13–17 Jun. 1971
(NASA-TM-X-67869; E-6415) Avail: NTIS CSCL 18J

The suitability of T-111 (Ta-8W-2Hf) clad uranium mononitride (UN) fuel for a lithium-cooled space power reactor concept is examined. Methods for fabrication of fuel pins are described. Out-of-pile compatibility testing indicates that at 1040 C a 0.013 cm (0.005 inch) thick tungsten barrier is required between the fuel and cladding; UN with < 300 ppm of oxygen is compatible with lithium; no corrosion of T-111 was observed after 7500 hours in a pumped-lithium loop. An irradiation program on fuel pins and cladding materials is also described. Author

N71-29019# Commissariat a l'Energie Atomique, Chusclan (France). Centre de Production de Plutonium de Marcoule.
STUDY AND DEVELOPMENT OF THE DECLADDING AND DISSOLUTION OF UO2 AND PuO2 FUELS CLAD WITH STAINLESS STEEL OR ZIRCALOY
Jacqueline M. Auchapt and Pierre R. Auchapt Nov. 1970 185 p refs In FRENCH
(CEA-Bib-191) Avail: AEC Depository Libraries

Processes were designed for decladding, some of them oriented toward pure research (stainless steel melting) and others capable of industrial applications (simple or complex electrolysis). Attempts were made to leach continuously the clad segments of sheared fuel and to pick the hulls out of the solution, but trials with simulated or real fuels were not successful. The three most widely used processes are electrolysis, chemical decladding, and mechanical shear-leach. The last two processes have industrial applications. Difficulties similar to those encountered in aqueous processing are experienced. NSA

N71-29039*# Scientific Translation Service, Santa Barbara, Calif.
REPORT OF WORK ON THE ITR PROJECT OF THE INSTITUTE FOR NUCLEAR ENERGETICS OF THE UNIVERSITY, STUTTGART [BERICHT WEBER ARBEITEN ZUM ITR-PROJEKT DES INSTITUTS FUER KERNENERGETIK DER UNIVERSITAET STUTTGART]
Washington NASA Jun. 1971 21 p ref Transl. into ENGLISH of Stuttgart Univ. report K-16
(Contract NASw-2035)
(NASA-TT-F-13703; K-16) Avail: NTIS CSCL 18I

Calculation results of the following are presented for the ITR compact nuclear reactor: neutron cross section, multiplication constant, power, heat distribution, reactivity, temperature coefficients, fuel consumption, shielding, and dynamic operation characteristics. Author

N71-29115 National Lending Library for Science and Technology, Boston Spa (England).
THE BEHAVIOUR OF STAINLESS STEELS AND OF NICKEL OR ZIRCONIUM ALLOYS IN THE PRIMARY SYSTEMS OF NUCLEAR POWER PLANTS
G. Herbelab 28 Oct. 1970 41 p refs Transl. into ENGLISH from Mitt. Ver. Grosskesselbetr. (Duesseldorf), v. 50, no. 2, 1970 p 138–151
(NLL-Risley-Trans-2014-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 4 NLL photocopy coupons

The behavior of stainless steels, nickel alloy or zirconium alloy fuels in the primary systems of nuclear power plants is discussed. It is emphasized that the corrosiveness of such materials depends on the media used for heat transfer in the various reactor designs, and a detailed analysis of the corrosion mechanism in pressure water reactors, boiling water reactors, and graphite-moderated reactors is presented. In general, the following factors appear to have the most adverse effect on fuel performance: generalized corrosion; selective corrosion, which damages the materials without appreciable weight loss; intercrystalline stress corrosion that may also lead to stress cracking; and transcrystalline stress cracking. Author

N71-29168 National Lending Library for Science and Technology, Boston Spa (England).
SIMULATOR FOR Xe 135 POISONING IN NUCLEAR REACTORS
A. Novelli 5 Mar. 1971 9 p Transl. into ENGLISH from Energia Nucl. (Milan), v. 16, no. 9, Sep. 1969 p 590–594
(NLL-CE-Trans-5363-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A small analog simulator, consisting of three milliampere linear microamplifiers, was designed for instructional purposes. Equations used to simulate the neutron flux distribution and the diagrams of the circuits which simulate them are given. N.E.N.

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N71-29047# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Lab. Nazionali di Frascati.
FIELD AROUND COMPENSATOR MAGNETS IN ADONE BEAM COLLIDING EXPERIMENT

C. J. Carpenter and U. Ratti 3 Nov. 1970 8 p ref
(LNF-70/50) Avail: AEC Depository Libraries

The transverse field around the compensator magnets is plotted by assuming two dimensional conditions, and the consequence of the approximations is examined. It is shown that the effect of the external field which is due to the projection of the compensator and windings produces an increase in compensator flux of more than 50%, and an even larger increase in the screening effect which the compensator has on the main flux. The flux intersecting different orbits through the magnets, may vary by several percent, with similar components at right angles to the main field and the orbit direction. A three dimensional solution is recommended, and is entirely practicable in numerical terms. Author (NSA)

N71-28085# Pomona Coll., Claremont, Calif. Dept. of Physics.
MAGNETO-OPTIC ROTATION ENHANCEMENT IN THIN MAGNETIC FILMS Final Technical Report
Charles A. Fowler, Jr. 25 Mar. 1971 18 p refs
(Contract N00014-67-C-0205)
(AD-721358; TR-11) Avail: NTIS CSCL 9/2

The effects of an antireflection coating of ZnS upon the magneto-optic rotations in a thin semitransparent NiFe film was investigated experimentally. The magneto-optic amplitude components, Kerr and Faraday, are observed to be augmented or diminished by the ZnS coating, depending upon the polarization mode of the incident light and the orientation of the coated specimen. A simple theoretical model accounts for the phenomena observed in the several experimental cases. Author (GRA)

N71-28142# Grumman Aerospace Corp., Bethpage, N.Y. Nuclear and Radiation Physics Section.
TRANSITION RADIATION FROM MAGNETIC MONOPOLES
John Dooher Jun. 1971 35 p refs Submitted for publication
(RE-410J) Avail: NTIS

Transition radiation from Dirac magnetic monopoles is calculated. The image picture is applied and compared with the rigorous solution of Maxwell's equation utilizing the symmetry between magnetic and electronic charges. Possible experimental applications are discussed in searching for monopoles in accelerators and cosmic radiation. Author

N71-28144# California Univ., Los Angeles. School of Engineering and Applied Science.
SUPERCONDUCTING MIXED STATE THERMAL IMPEDANCES Final Report
Y. W. Chang, C. Linnet, Vance Purdy, and T. H. K. Frederking May 1971 134 p refs
(Grant NSF GK-2195)
(UCLA-ENG-7109) Avail: Issuing Activity

Type II superconductor research concerned with Nb and Nb-Ti wire studies is summarized with emphasis on thermal effects on take-off transport currents and thermal resistances. The major results were obtained with type II-normal metal junctions, such as Nb-Cu and NbTi-Cu junctions. The contact conductances were found to be one order or more lower than the best junction conductances of pure type I-normal metal junctions. The NbTi-Cu alloy junction conductances were substantially lower than the Nb-Cu junction conductances. The latter were affected by the superconducting-normal state phase transition. The conductance in the superconducting state was smaller than in the normal state. In the mixed state, a phonon dip was always observed at low temperatures; above 4 K it was absent. The investigations were supplemented by vortex flow studies in the weak-pinning medium He II. The state of the disordered liquid layers near solid walls is investigated by using the local vaporization threshold as a thermodynamic probe. This method shows properties of the superfluid which apparently are analogous to the type II superconductor phenomena. Author

N71-28179# California Univ., La Jolla. Dept. of Physics.
THERMAL CONTACT: A NARRATIVE OF SOME EXPERIMENTS IN LOW TEMPERATURE PHYSICS
John C. Wheatley [1970] 24 p
(Contract AT(04-3)-34)
(UCSD-34-P-143-37) Avail: NTIS

Experiments on heat transfer rates and thermal contacts are reviewed. The importance of thermal resistance, the development of experiments using liquid He-3 and He-4, measurement of the heat capacity of He-3, measurements on dilute solutions of He-3 in He-4, the action of small amounts of He-4 in He-3, and magnetic fluctuations are described. It is felt that adiabatic compression of a two-phase mixture of pure liquid and solid He-3 is probably the most powerful means of producing refrigeration in the 2 to 50 millidegree range. N.E.N.

N71-28240# Pennsylvania State Univ., University Park. Ordnance Research Lab.
ON THE TRANSMISSION OF SOUND FROM A MONOPOLE SOURCE THROUGH A FINITE, CORRUGATED BOUNDARY BETWEEN FLUID MEDIA
J. A. Macaluso (Ph.D. Thesis) 9 Feb. 1970 140 p refs
(Contract N00017-70-C-1407)
(AD-722029; TM-214-02) Avail: NTIS CSCL 20/1

The investigation was undertaken with the objective of developing techniques for solving the problem of sound transmission from a harmonic monopole source through a finite, corrugated boundary between fluid media and to corroborate these techniques by means of laboratory data obtained for the important case of air-to-water sound transmission. Using a form of the Kirchoff radiation integral, expressions were derived describing both the reflected and transmitted acoustic potentials due to the scattering of monopole sound at a corrugated boundary between fluids. For the case of sound transmission through the boundary, the integral expression was reduced to an approximate closed-form solution which is valid in the limit of geometrical optics and for extended interface geometries for which the tangent plane approximation is applicable. Empirical data was obtained using four different laboratory models of corrugated (sinusoidal) surface sections designed to float on the surface of an anechoic tank so as to simulate different corrugated air-water boundaries. Author (GRA)

N71-28417# Technische Hogeschool, Delft (Netherlands). Afdeling der Technische Natuurkunde.
OPTICAL IMAGING OF ULTRASONIC FIELDS BY ACOUSTIC BRAGG DIFFRACTION
Adrianus Korpel (Ph.D. Thesis) 1969 199 p refs
Avail: NTIS

An attempt is made to formulate a general theory for Bragg diffraction imaging in terms of plane waves and to substantiate this with experimental investigations. The study has been placed in the context of acoustic visualization techniques in general. ESRO

N71-28458# Sperry Rand Corp., Huntsville, Ala. Space Support Div.
DIFFUSION OF TRANSIENT ELECTROMAGNETIC FIELDS THROUGH SATURATED FERROMAGNETIC MEDIA Final Report
D. J. Kozakoff Jun. 1970 19 p refs
(Contract DACA87-69-C-0009)
(AD-721906; SR-48114-D) Avail: NTIS CSCL 20/14

Intense transient electromagnetic pulse fields may drive a ferromagnetic shield into saturation, thus reducing the shielding effectiveness of that shield. Often shielding computations ignore saturation effects due to the complexity of the equations. This memorandum reduces the complexity of the calculations by combining the approaches of several authors. The ferromagnetic material characteristics are incorporated directly into the field

equations, amenable to computer solution. A math model of the material characteristics is presented. The magnetic permeability at a point in the ferromagnetic material is expressed as a function of H. The boundary conditions of the magnetic field equations in the time domain are developed. The numerical solution for the field emerging on the inside surface of an infinite sheet is accomplished by solving a differential equation subject to the boundary conditions. Certain approximations are indicated to simplify the calculations. The computer flow diagram is illustrated. Author (GRA)

N71-28463# Denver Research Inst., Colo. Div. of Mathematical Sciences.

SCATTERING THEORY FOR WAVE PROPAGATION PROBLEMS OF CLASSICAL PHYSICS BY THE METHOD OF LAX AND PHILLIPS Technical Summary Report

James A. La Vita, John R. Schulenberger, and Calvin H. Wilcox Mar. 1971 101 p refs

(Contract N00014-67-A-0394-0002)

(AD-721723; MS-R-7126; TSR-13) Avail: NTIS CSCL 20/10

The paper presents an application of the scattering theory of P. D. Lax and R. S. Phillips to a class of wave propagation problems of classical physics. The problems are governed by symmetric hyperbolic systems. The generalization of the results of Lax and Phillips presented here is based on a new coerciveness theorem for nonelliptic operators due to Schulenberger and Wilcox. Author (GRA)

N71-28464# Boeing Scientific Research Labs., Seattle, Wash. Flight Sciences Lab.

NONLINEAR ACOUSTIC BEHAVIOR AT A CAUSTIC

R. Seebass Feb. 1971 53 p refs

(AD-721932; D1-82-1039) Avail: NTIS CSCL 20/1

The paper is concerned with modifying the basic theory of sonic booms to include nonlinear effects not properly accounted for in the neighborhood of a caustic. The basic theory accounts for nonlinear effects on the propagation of the pressure signal down a ray tube, but the concept of ray tubes is a linear one. The envelope of the rays is a caustic surface; this surface is the locus of cusps in the acoustic wave fronts. Interest is in the detailed structure of the wave front as it reflects at a caustic surface. Author (GRA)

N71-28722# Columbia Univ., New York.

SYMMETRY PRINCIPLES IN PHYSICS.

T. D. Lee May 1970 19 p refs Sponsored by AEC

(BNL-50261) Avail: NTIS

Symmetry operations are reviewed, and their foundations examined. Nonobservables, symmetry transformations and conservation laws, asymmetries and observables, time reversal, complementarity of symmetry violations, and aesthetical considerations are covered. NSA

N71-28748# New York Univ., N.Y. Geophysical Sciences Lab.

AN EXPERIMENTAL STUDY OF GRAVITY WAVE BEHAVIOR NEAR A STRAIGHT CAUSTIC

Yung-Yao Chao and Willard J. Pierson, Jr. Dec. 1970 47 p refs

(Contract N00014-67-A-0467-0012)

(AD-721437; GSL-TR-70-17) Avail: NTIS CSCL 8/3

An experimental study of gravity wave behavior near a straight caustic generated on a uniformly sloping bottom was carried out in a 4.26 meters (14 feet) square and 30.48 centimeters (1 foot) deep wave tank. Gravity waves were generated in shallow water of constant depth and propagated toward a portion of the tank where the depth increased linearly to a value equivalent to deep water. The straight line which the depth started to increase was 50 degrees to the wave crests at the generation source. The waves propagated up to this line, then refracted, totally reflected, and turned back toward the shallow water. The results of the experiment show that the experimental model not only successfully produces a caustic but also verifies the theoretical results near the caustic derived recently by Chao (1970) within a linear theory. When waves approach the caustic their amplitudes increase monotonically and attain maximum values within the caustic boundary that are about two times the amplitude in the source region. Near the caustic in the shadow region, the amplitudes decrease exponentially. Author (GRA)

N71-28777*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

NONLINEAR ACOUSTIC THEORY FOR RIGID POROUS MATERIALS

William E. Zorumski and Tony L. Parrott Washington Jun. 1971 27 p refs

(NASA-TN-D-6196; L-7327) Avail: NTIS CSCL 20A

Nonlinear instantaneous relationships between acoustic pressure differential and velocity are postulated to describe the acoustic characteristics of a rigid porous material, and the concept of a temporal impedance operator is introduced. The new theory is valid for any wave, irrespective of frequency, intensity, or distortion. A new experimental method is given for measuring these properties in a high intensity impedance tube. The measurement method is independent of wave distortion. Results of an experimental study of a typical material are presented in terms of nonlinear instantaneous resistance and reactance. The instantaneous resistance is found to be independent of the test frequency and is therefore identical to the flow resistance. The instantaneous reactance is found to be a function of the acoustic fluid velocity. Author

N71-28819*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

TWO-PHASE CRITICAL DISCHARGE OF HIGH PRESSURE LIQUID NITROGEN

R. J. Simoneau, R. E. Henry, R. C. Hendricks, and R. Watterson 1971 9 p refs Proposed for presentation at 13th Intern. Congr. of Refrig., Washington, D.C., 27 Aug.–3 Sep. 1971

(NASA-TM-X-67863; E-6403) Avail: NTIS CSCL 20L

Experimental data are reported for the two phase critical flow of saturated and subcooled liquid nitrogen through a convergent-divergent nozzle. The nozzle inlet conditions range from highly subcooled liquid to conditions very near the thermodynamic critical point. The results show that liquid nitrogen exhibits the same general nozzle behavior as water and is in agreement with a recent two phase critical flow model. Author

N71-28888*# National Aeronautics and Space Administration. Washington, D.C.

THE USE OF SUPERCONDUCTORS FOR STORAGE AND DISCHARGE OF ELECTRICAL ENERGY [L'UTILISATION DES SUPRACONDUCTEURS POUR LE STOCKAGE ET LA DECHARGE DE L'ENERGIE ELECTRIQUE]

J. Sole Jul. 1971 137 p refs Transl. into ENGLISH from French report CEA-R-3515

(NASA-TT-F-13559; CEA-R-3515) Avail: NTIS CSCL 20L

The principle of storage and liberation of energy is presented in its elementary form. A more detailed analysis of the successive charging, trapping storage, and discharge operations shows up the different aspects of the problem, and is followed by a review of the research published so far on this subject. The use of superconductors for application to the storage and discharge of electrical energy is proposed. E.M.C.

N71-28883# Joint Inst. for Nuclear Research, Dubna (USSR).

INVESTIGATION OF THE MODEL OF THE 2-METER STREAMER CHAMBER OF THE SCM-200 ASSEMBLY

V. D. Volodin, N. S. Glagoleva, Yu. A. Karzhavin, P. S. Kuznetsov, A. T. Matyushin et al 1970 13 p refs In RUSSIAN

(JINR-P13-5529) Avail: AEC Depository Libraries

Development of streamers, photographed at different angles to the electromagnetic field direction (0, 22, 30 and 40 deg), is investigated. A brief description of the equipment used is given and results are discussed. NSA

N71-29002*# Scientific Translation Service, Santa Barbara, Calif.
PHOTRON THEORY OF LIGHT AND MATTER [PHOTRONENTHEORIE DES LICHTES UND DER MATERIE]
K. Nowak Washington NASA Jun. 1971 10 p refs Transl. into ENGLISH from Neue Physik (Vienna), 1969 p 1–9
(Contract NASw-2035)
(NASA-TT-F-13695) Avail: NTIS CSCL 20J

A theoretical model is postulated that explains light as a motion of subatomic corpuscles whose subelectric charges are connected with each other by accompanying waveforms. The calculated specific charge for these hypothetical photrons is about 2.5 times 10,000 of the specific electron discharge; this establishes that the carrier's subelectric charge is much smaller than the electric elemental charge but much higher in relation to photron mass. Positive and negative photrons are also regarded as basic building materials of matter; in this context, the subelectric charge is a property bound to the submatter. A new atomic model explains photronic light emission by the laws of elastic shock. Thus, light velocity is a mechanical motion relative to the emitted atom which is constant because the mass of light quanta increases linear to the discharge energy. Author

N71-29025*# National Aeronautics and Space Administration, Washington, D.C.
ANALYTIC SYSTEM FOR OPTICAL TRACKING DEVICES [SYSTEME DE'ANALYSE POUR DISPOSITIFS DE REPERAGE OPTIQUE]
Jun. 1971 15 p Transl. into ENGLISH from French patent no. 1259951 (1961) 8 p
(NASA-TT-F-13708) Avail: NTIS CSCL 20F

An analytical system for an optical tracking device is described that allows tracking to be carried out in the direction of an object or target having a contrast or differences of luminous or infrared intensity. The device is applied chiefly in the design of target seeking heads for homing or remote controlled systems such as: aircraft, rockets, projectiles, and tracking apparatus in general. Author

N71-29049* Microwave Electronics Corp., Palo Alto, Calif.
SUPERCONDUCTING MAGNET Patent
William Pinkney Jones and William A. Peterson, inventors (to NASA) Issued 13 Sep. 1966 5 p Filed 28 May 1964 Cl. 335-216 Sponsored by NASA
(NASA-Case-XNP-06503; US-Patent-3,273,094; US-Patent-Appl-SN-370989) Avail: US Patent Office CSCL 20C

Superconducting magnets operable within a vacuum and made of a plurality of turns of superconductive wire fed with electricity through a generally non-superconducting wire is described. Official Gazette of the U.S. Patent Office

N71-29094 National Lending Library for Science and Technology, Boston Spa (England).
RELATION BETWEEN THE WATER-VAPOUR PRESSURE AND THE CONCENTRATION OF THE ANOMALOUS COMPONENT IN MODIFIED WATER [ZAVISIMOST DAVLENIYA VODYANOGO PARA OT KONTSENTRATSII ANOMALNOGO KOMPOMENTA V MODIFITSIROVANNOI VODE]
B. V. Deryagin et al 18 Sep. 1970 7 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), no. 190 (2) p 372–375
(NLL-Lib-Comm-1552-(5196)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The interaction between the vapor pressure of ordinary water and the anomalous component of modified water was studied experimentally, and the results compared to the calculations using Raoult's law. The preparation of the modified water columns in quartz capillaries is described. It was found that the mean value of the molecular weight is 180 plus or minus 50. F.O.S.

N71-29123* California Univ., Berkeley.
ADJUSTABLE MOUNT FOR A TRIHEDRAL MIRROR Patent
Harry W. Petersen and Raymond O. Laurie, inventors (to NASA) Issued 13 Apr. 1971 6 p Filed 13 May 1969 Cl. 350-310; Cl. 350-102; Cl. 350-288; Int. Cl. G02B5/08 Sponsored by NASA
(NASA-Case-XNP-08907; US-Patent-3,574,448; US-Patent-Appl-SN-824042) Avail: US Patent Office CSCL 20F

An adjustable mount for a trihedral mirror with three contiguous triangular segments of mirror surface is described. Each mirror segment is disposed in a plane substantially perpendicular to the planes of the other two segments and supported by a structure including rigidly connected plates and adjusting screws, formed of an alloy having a small coefficient of thermal expansion. This allows for accomodating and adjustable displacement of the surfaces of the mirror segments while inhibiting an introduction of heat-induced error. Official Gazette of the U.S. Patent Office

N71-29125* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
METHOD AND APPARATUS FOR ALIGNING A LASER BEAM PROJECTOR Patent
Michael S. Shumate, James A. Westphal, and Lewis H. Allen, inventors (to NASA) Issued 13 Apr. 1971 5 p Filed 9 Jul. 1969 Cl. 356-153; Cl. 331-94.5; Int. Cl. G01b11/27 Sponsored by NASA
(NASA-Case-NPO-11087; US-Patent-3,574,467; US-Patent-Appl-SN-840359) Avail: US Patent Office CSCL 20F

A laser beam projector comprising an optic system with a very long focal length is described. A method for achieving continuous, precise alignment between the laser generator, the optic system employed as a laser beam projector, and the target being tracked is also described. Detailed descriptions accompany drawings of the device. Official Gazette of the U.S. Patent Office

N71-29126 California Univ., Los Angeles.
THE RESONANCES OF A FERRITE-FILLED SPHERICAL CAVITY RESONATOR
David Allen Taggart (Ph.D. Thesis) 1969 170 p
Avail: Univ. Microfilms Order No. 70-14330

An eigenfunction expansion technique is developed to determine the resonances of a cavity resonator whose walls are perfectly conducting and which is filled with loss-free material. This technique is then applied for the determination of several of the resonance frequencies of a ferrite-filled spherical cavity resonator. This eigenfunction expansion technique requires the representation of the unknown B-field inside the cavity by a complete set of solenoidal isotropic cavity mode B-fields. A variational expression is developed which relates the resonance frequency to the B-field inside the cavity. The B-field expansion is substituted into the variational expression and the Rayleigh–Ritz technique is then applied. The resultant system of equations is put into the form of a matrix eigenvalue equation. The infinite dimensional matrices are approximated by finite dimensional matrices and standard computational techniques are suggested for the determination of the unknown eigenvalues and eigenvectors. This eigenfunction expansion technique is compared with other approximation techniques which exist in the literature. Dissert. Abstr.

N71-29127 California Univ., Berkeley.
INVESTIGATIONS OF INFRARED RADIATION AND TRANSPORT IN GASES
Shih Hung Chan (Ph.D. Thesis) 1969 101 p
Avail: Univ. Microfilms Order No. 70-13028

Infrared absorption and energy transport in gases was investigated. The low resolution measurements of infrared absorption are presented for nu 1, nu 2, 2 nu 1 and nu 1 + nu 3 bands of sulfur dioxide. These measurements were performed at room temperature and at the optical pathlengths such that data cover the transition and strong absorption regions. Two analytical methods are developed for evaluating the total band absorptance of a nonisothermal infrared-radiating gas, a parameter necessary for the calculation of radiative transfer in nongray, nonisothermal gases. One method concerns a wide-band formulation of the Curtis–Godson approximation, and the other is based on a series-expansion formulation. In both methods, existing information of isothermal gas radiation can be utilized to evaluate nonisothermal gas radiation. Good agreement is shown between the present predictions and available experimental data. Dissert. Abstr.

N71-29130 Wisconsin Univ., Madison.
MAGNETIC EFFECTS IN THE OPTICAL ABSORPTION SPECTRUM OF RUBIDIUM NICKEL FLUORIDE
James Tylicki (Ph.D. Thesis) 1969 130 p
Avail: Univ. Microfilms Order No. 70-3732

The effects of magnetic ordering upon the optical absorption spectrum of RbNiF3 are studied. In particular, the polarized optical absorption spectrum for the hexagonal ferrimagnet RbNiF3 is considered for the transitions from the ground state 3A2 to excited states 3T2 and 1T2(a). For the 3T2 manifold an effective Hamiltonian is constructed and its parameters are adjusted to match the levels of the observed spectrum. Oscillator strengths are calculated from the resulting wave functions and produce reasonable agreement with the measured values for this manifold. The reorientation of the exchange field from the basal plane to the c-axis direction is seen to manifest itself in a very direct way through the behavior of the oscillator strengths of some of the features in the 1T2(a) manifold. The space group symmetry appropriate to the magnetically ordered state is discussed in detail. Dissert. Abstr.

N71-29165# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Serpukhov (USSR). Institut Fiziki Vysokikh Energii.
TOPOGRAPHY OF THE MAGNETIC FIELD AT THE 70-GeV ACCELERATOR [TOPOGRAFIYA MAGNITNOGO POLYA V OTKRYTOM I ZAKRYTOM BLOKAKH ELEKTROMAGNITA USKORITELYA NA ENERGIYU 70 GEV]
V. V. Komarov, I. Ya. Korol'kov, A. A. Dednev, and V. S. Marshanskii 1969 23 p refs In RUSSIAN
(IFVE-SKU-69-95) Avail: AEC Depository Libraries

The data on measuring the magnetic field topography in the gap of the open and closed units of the electromagnet of the IHEP accelerator and in the region of fringing fields during injection are given. The measurement methods and the apparatus used for this purpose are briefly described. Author (NSA)

N71-29195# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
NEW DEVELOPMENTS IN ULTRASONIC COATING THICKNESS MEASUREMENTS
D. R. Newman 18 May 1970 11 p refs Presented at the Meeting of the NDT Groups of the AEC Weapons Program, Miamisburg, Ohio, 8 Apr. 1970
(Contract AT(45-1)-1830)
(BNWL-SA-3279; CONF-700435-2) Avail: NTIS

Recent developments of two ultrasonic techniques for measuring metal coating thickness, leading to significant improvements in the range, resolution, and accuracy of these techniques, are described. The first method is the measurement of the critical angle of an ultrasonic beam at a liquid-solid interface; the second method uses a new technique of generating very short pulses of ultrasound only one-half cycle long. The mechanisms for obtaining information and the areas of optimum application tend to be different. Author

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N71-28019# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Angewandte Kernphysik.
A MEASUREMENT OF THE FISSION CROSS SECTION OF U 235 AT 440- and 530-keV NEUTRON ENERGY
F. Kaeppeler Nov. 1970 14 p refs Presented at EANDC Symp. on Neutron Std. and Flux Normalization, Argonne, Ill., 21–23 Oct. 1970 Supported by US-EURATOM Fast Reactor Exchange Program
(KFK-1313; EURFNR-880; Conf-701002-3) Avail: AEC Depository Libraries

The fission cross section of U-235 was measured at two neutron energies using a gas scintillation chamber for registering the fission events and a telescope-like proton recoil detector for determining the neutron flux. The neutrons were produced via the Li-7(p,n)Be-7 reaction at the 3 MV pulsed Van de Graaff accelerator. The time of flight method served for background discrimination. At 440 + or − 25 keV neutron energy the result was fisson cross section = 1.17 barns + or − 3.5% and at 530 + or − 30 keV fisson cross section = 1.17 barns + or − 3.5%. Author (NSA)

N71-28020# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Neutronenphysik und Reactortechnik.
MICROSCOPIC NEUTRON NUCLEAR DATA AND 5-GROUP CROSS SECTIONS FOR THE ACTINIDES Pa 231, U 232, U 234, U 236, U 236, Np 237, Np 238, Pu 238, Pu 238, Am 214, Cm 242
B. Hinkelmann Jul. 1970 76 p refs Supported by US-EURATOM Fast Reactor Exchange Program
KFK-1186; EURFNR-862; EANDC(E)-128-U) Avail: AEC Depository Libraries

A first step is presented in the framework on an accurate systematic evaluation for the transactinium isotopes. Microscopic neutron nuclear data were evaluated and 5-group values derived for the radiative capture, the fission, the (n,2n) cross section, and for the mean number of neutrons per fission. In the case of lack of experimental data simple systematic methods were applied for the determination of the cross sections. Author (NSA)

N71-28023# Helsinki Univ. (Finland). Research Inst. for Theoretical Physics.
A MOLECULAR DYNAMICS INVESTIGATION OF THE COHERENT SCATTERING FUNCTION OF SIMPLE FLUIDS
J. Kurkijaervi (Ph.D. Thesis) 1970 40 p refs /ts Ann. Acad. Scientierum Fennicae Ser. A, 6: Phys. No. 346
Avail: NTIS

Molecular dynamics results for the coherent scattering function of a Lennard-Jones fluid are presented at three pairs of density and temperature, two in the liquid phase and one in the gas phase. Theoretical predictions are tested and excellent agreement is found at high values of the momentum transfer in the case of a parameterless formula for the coherent scattering function in terms of the incoherent one when the formula is constructed to satisfy the momentum relations up to the fourth. Author

N71-28028# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Reaktorentwicklung.
COLLI: PROGRAM PACKAGE FOR CALCULATION OF THERMAL NEUTRON SCATTERING [COLLI: EIN PROGRAMMZYKLUS ZUR BERECHNUNG DER STREUUNG THERMISCHER NEUTRONEN]
Guenter Schroeder Jul. 1970 139 p refs In GERMAN
(JUL-668-RG) Avail: AEC Depository Libraries

The program package COLLI calculates the scattering law S(alpha,beta;T) for moderators of random structure and composition (for example, crystals consisting of one or more atomic species, molecules, liquids, etc.); for these moderators the frequency distribution of the atomic oscillations (phonon spectrum) and the bound cross sections (sigma bound, scattering lengths) of the individual atoms are already known for a given temperature in incoherent approximation. The scattering law can be stored in the ENDF/B format for several moderator temperatures on magnetic tapes (program LIBRA), so that in the calculation of the scattering matrix a temperature interpolation is possible. The calculation of the scattering matrix of beryllium oxide from the phonon spectrum of Sinclair for 293 K is given with complete input and output as a typical example. The listings of the main program COLLI and the program SIGMA are included. The calculated scattering matrix of beryllium oxide is given for 293 K in the 96-energy-group distribution of the THERMOS program. NSA

N71-28027# Lyon Univ. (France). Inst. de Physique Nucleaire.
SU3 FRACTIONAL PARENTAGE IN THE 1-p SHELL
J. Meyer, R. S. Nahabetian, J. Joseph, and J. Lafourcriere Nov. 1970 20 p refs
(LYCEN-7078) Avail: AEC Depository Libraries

Using the ELLIOTT SU-3 model, the fractional parentage coefficients occurring in matrix elements for various n-particle operators (n = 1,2,3, and 4) and in the reduced widths of the p shell nuclei for deuterons, tritons, and alpha particles, were calculated. The programs used are described. NSA

N71-28028# Atomic Energy Commission, Baghdad (Iraq).
OPTIMUM THICKNESS OF SINGLE CRYSTAL NEUTRON MONOCHROMATORS
K. I. Said and J. J. Sarah Oct. 1970 10 p refs
(PH-4) Avail: AEC Depository Libraries

The optimum thickness of a copper single crystal neutron monochromator was measured experimentally and comparison with theoretical predictions shows reasonable agreement. Knowledge of the crystal's mosaic spread is necessary for these calculations and suggestions for further work are made. Author (NSA)

N71-28030# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
DOSIMETRY APPLICATIONS OF THERMALLY STIMULATED ELECTRON EMISSION [APPLICAZIONI DOSIMETRICHIE DELLA EMISSIONE TERMOSTIMOLATA DI ELLETRONI]
E. Rotondi and F. Bordoni 31 Jul. 1970 35 p refs In ITALIAN
(RT/FI(70)37) Avail: AEC Depository Libraries

The use of the TSEE properties of irradiated material for dosimetry is discussed. Ceramic beryllium oxide and calcium sulfate (pure and doped with samarium, manganese, and lead) were studied. The activators in calcium sulfate were found to decrease the exoelectron yield. Properties of beryllium oxide for use as a personnel dosimeter are discussed. Author (NSA)

N71-28033# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
INVESTIGATION OF THE HI 175 EXCITED STATES IN THE Ta 175 DECAY
V. Gadjokov, J. Zvolsky, J. Molnar, and N. Nenoff 1970 27 p refs In RUSSIAN
(JINR-P6-5434) Avail: AEC Depository Libraries

The spectra of the conversion electrons and gamma rays were studied. The experiments on gamma - gamma coincidences with 22 gamma-lines were performed using Ge(Li) detectors. The decay scheme Ta-175/HF-175 with 23 new levels introduced is suggested. The obtained data on Hf-175 levels are compared with the theoretical calculations in the framework of superfluid model on the basis of the Saxon - Woods potential. The rotational bands of 642 states are introduced among which the Coriolis interaction takes place. Author (NSA)

N71-28034# Atomic Energy Commission Research Establishment, Riso (Denmark). Metallurgy Dept.
NUCLEATION OF DAMAGE CENTRES DURING ION IMPLANTATION OF SILICON
Lewis T. Chadderton Sep. 1970 25 p refs
(RISO-236) Avail: AEC Depository Libraries

Nucleation of damage centers in single crystal silicon held at room temperature and bombarded in a random direction with light ions is not at all times heterogeneous, as has sometimes been assumed. During these periods of nucleation and primary growth, small interstitial clusters behave as unsaturable traps. For higher fluences there is a smooth transfer to a form of heterogeneous nucleation, which is not of displacement cascade origin. In this period of secondary growth, the state of disorder varies linearly with ion fluence, and interstitial clusters behave as nucleation traps. It is shown how marked effects on the state of disorder due to changes in the mass of the bombarding ion, in the flux of the impinging beam, or in the temperature and impurity content of the bombarded crystal can be simply traced to an assistance for or a resistance to the onset of heterogeneous over homogeneous nucleation. Author (NSA)

N71-28044*# Hughes Aircraft Co., Culver City, Calif.
STUDY OF COLOR CENTER FORMATION IN WHITE POWER COMPOUNDS Summary Report, 1 Sep. 1969 - 30 Sep. 1970
Herman Levin, Cedric C. Berggren, and Willard M. Peffley Dec. 1970 83 p refs
(Contract NAS2-5034)
(NASA-CR-118865) Avail: NTIS CSCL 20H

An experimental investigation of typical foreign (impurity) defects and native defect generation by low energy protons was performed. In-situ (vacuum) optical and spin resonance spectra were obtained which upon resolution revealed individual defect species and their densities. Analysis of these data provided a basis for correlating the growth kinetics of various color centers, including those associated with substitutional impurities and those associated with native lattice defects. It was established that the dominant coloration mechanism consists of electron-hole pair diffusion into the crystal bulk (from a surface layer in which they are generated - proton range) followed by recombination and trapping in the bulk. This diffusion-dependence in the bulk (rather than proton displacement in the surface layer) greatly increases the influence of initial defect structure on the resultant optical damage. Author

N71-28048# Institute of Nuclear Research, Warsaw (Poland).
EQUILIBRIUM DEFORMATIONS OF THE GROUND AND EXCITED STATES IN THE RARE EARTH NUCLEI
W. Stepien-Rudzka 1970 12 p refs
(INR-P-1216) Avail: AEC Depository Libraries

The equilibrium deformations of the ground and excited states in nuclei in the rare earth region are calculated using the new Nilsson model. The residual interactions are taken into account in the form of pairing forces. Comparison is made with previous calculations of similar type together with a suggestion of applying the idea of different deformations in ground and excited states of this same nucleus in analogue state physics. Author (NSA)

N71-28049# Joint Inst. for Nuclear Research, Dubna (USSR).
ON THE PROBLEM OF ION ACCELERATION BY THE ELECTRON RING IN THE DECREASING MAGNETIC FIELD
I. N. Ivanov, E. A. Perel'shtein, and V. P. Serentsev 1970 11 p In RUSSIAN
(JINR-P9-5535) Avail: AEC Depository Libraries

The problem of keeping the ions in the potential well of the electron ring when accelerating it in the decreasing magnetic field is considered. Author (NSA)

N71-28060# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.

A BRIEF REVIEW OF THE REPORTS SUBMITTED TO THE SECOND INTERNATIONAL SYMPOSIUM ON NONLOCAL QUANTUM FIELD THEORY

G. V. Efimov and M. K. Volkov 1971 18 p ref Symp. held at Azau, USSR, 15–24 Mar. 1970

(JINR-E2-5563) Avail: AEC Depository Libraries

The reports submitted to the International Symposium on Nonlocal Quantum Field Theory are briefly reviewed. Author (NSA)

N71-28066# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.

TRANSFORMATION PROPERTIES OF MASSIVE PARTICLE STATES AT INFINITE MOMENTUM

D. Robashik and Ya. A. Smorodinskii 1971 15 p refs

(JINR-E2-5579) Avail: AEC Depository Libraries

The well-known result that helicity states of massive particles with infinitive momentum satisfy the same transformation laws as the states of massless particles is derived. The limiting procedure holds p squared - m squared fixed whereas the spatial momentum tends to infinity. For canonical states at infinite momentum the Wigner rotation is a rotation around the axis with the angle alpha = theta - theta prime, theta and theta prime being the well known angles occurring by the aberration of light. The rotation angle phi appearing by the transformation of the helicity states is in a simple way connected with the angle alpha. For a general Lorentz transformation it is also possible to calculate the value of the angle phi. Author (NSA)

N71-28067# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions.

THE VALIDITY OF THE ALEXANDER AND SIMONOFF SEMIEMPIRICAL RULE IN THE REGION 100 < OR = TO A < OR = TO 150

W. Neubert 1970 9 p refs Presented at the Ann. Rossendorf-Cracow Conf., Cracow, 1970 Submitted for publication

(JINR-E7-5499) Avail: AEC Depository Libraries

The Alexander and Simonoff semiempirical rule concerning the maximum position of the cross section for (H, I., xn) reactions is checked. The validity of this relation in the medium mass region 100 < or = to A < or = to 150 is shown on the basis of 19 well established excitation functions. Author (NSA)

N71-28079# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions.

ANGULAR DISTRIBUTIONS AND EXCITATION FUNCTIONS FROM THE (N 15,N 16), (N 14,N 16), (N 15,N 17), (N 14,N 17) REACTIONS

A. G. Artukh, V. V. Volkov, L. Pomorsky, and Ya. Tys 1970 18 p refs In RUSSIAN

(JINR-P7-5494) Avail: AEC Depository Libraries

Angular distributions and excitation functions of the pickup reactions with one, two and three neutrons were measured by bombarding a number of nuclei with N-14 and N-15 ions. The boundary character of the studied reactions is established. The dependence of the reaction cross sections on the binding energy of the neutron in the donor nucleus is obtained. Author (NSA)

N71-28081# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.

ASYMMETRIC DEFORMATION OF FISSIONING NUCLEI

V. V. Pashkevich 1971 39 p refs In RUSSIAN

(JINR-P4-5581) Avail: AEC Depository Libraries

The potential energy of a nucleus at large (scission) deformation is calculated by the shell correction method due to Strutinsky. The shape of the nucleus in the zeroth-order approximation is taken to be the Cassinian ovaloid, the deviation being expanded in a series in Legendre polynomials. Asymmetric shapes of the nucleus are studied. A definition of the Woods–Saxon type nuclear potential is given. The single particle spectrum, shell correction, liquid-drop energy and total potential energy are calculated. It is shown that the transuranium nuclei are symmetric at the first barrier and in the second minimum of the potential energy. The second saddle point is situated at large asymmetric deformation. The nuclear asymmetry near the scission point is in qualitative agreement with the experimental data on the asymmetry in the mass distribution of the fission fragments. The agreement between the theoretical results and the experimental data on the fission barriers is improved when the asymmetry is taken into account. Author (NSA)

N71-28083# Comitato Nazionale per l'Energia Nucleare, Bologna (Italy). Centro di Calcolo.

SOLUTIONS FOR THE INTEGRAL NEUTRON TRANSPORT EQUATION BY DIRECT DECOMPOSITION OF ITS KERNEL

F. Premuda 1970 43 p refs

(RT/FI(70)27) Avail: AEC Depository Libraries

A new method is presented for solving the integral Boltzmann equation for monoenergetic neutrons. The kernel of such an equation is expanded into a series of polynomials of one of its variables in each region of the physical system, one- or multi-layer, considered. The spatial distribution in both critical and subcritical conditions and the criticality equation are obtained without resorting to the eigenfunction expansion method or to the integral transformation technique. The angular flux is also evaluated, through the integral equation, which relates it to the total flux on the hypothesis of isotropic scattering and fission. Author (NSA)

N71-28084# Institute of Nuclear Physics, Krakow (Poland).

PERTURBED ANGULAR CORRELATIONS FOR THE 596-42-keV CASCADE IN Cu 62

E. Bozek, J. Golczewski, A. Z. Hrynkiewicz, M. Rybicka, J. Styczen et al 1970 8 p refs

(INP-734) Avail: AEC Depository Libraries

The perturbation of the directional correlation was measured in external and internal magnetic fields for liquid and metallic (Zn in Ni) sources of Zn-62, respectively. The experiments were performed by the differential and integral methods. An external magnetic field of 13.2 kG was applied in the measurements with the liquid source, and fields of 13.2 kG and 3.0 kG were used in the measurements with the metallic sources. The experimentally determined values of the g factor of the 42-keV state in Cu-62 and the internal magnetic field acting on Cu nuclei in the Ni lattice are 0.67 + or - 0.06 and 48.2 + or - 10.4 kGs, respectively. Author (NSA)

N71-28085*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

CONSIDERATION OF SIMPLE MODEL ATOMS FOR ARGON DISCHARGE CALCULATIONS

James R. Rose and John V. Dugan, Jr. Washington Jun. 1971 20 p refs

(NASA-TN-D-6383; E-6220) Avail: NTIS CSCL 20H

Simple model atoms are useful for satisfactory calculation of plasma properties in gas discharges with low electron temperature. Model atoms of 2-, 3-, and 5-levels give ionization fraction f in satisfactory agreement with 26-level results for cesium plasmas that are optically thick to resonance radiation. The calculation of nonequilibrium f values is extended to argon discharges of electron temperature values of 8000 and 11,605 K. The calculated values of f closely approximate the Saha predictions in the completely thick radiation limit. Level inversions are calculated at both electron temperature values for argon plasmas that are optically thick to resonance radiation. Author

N71-28086# United Kingdom Atomic Energy Authority, Harwell (England). Chemistry Div.
THEORY OF DELAYED NEUTRON PHYSICS
L. Tomlinson Nov. 1970 18 p refs
(AERE-R-6596) Avail: AEC Depository Libraries

The 38 isotopes formed in fission that have the property of delayed neutron emission were studied. The mass regions in which delayed neutron emission occurs were found to be in agreement with the predictions of two recent mass formulas. Partial success was achieved in relating the delayed neutron emission probability of the delayed neutron precursors to basic nuclear parameters—notably, the distance of the precursor from the line of beta-stability and also the energy window available for delayed neutron emission. Recent theoretical calculations yielded delayed neutron energy spectra for the 55 and 22 second groups of the same shape as the experimental spectra. It is believed that most of the delayed neutron precursors with half-lives greater than 2 seconds are now known. Using the values of these precursors and calculated cumulative fission yields, it is possible to account for the gross delayed neutron emission from many types of fission. Calculations are given for thermal, fast and 14 MeV fission to illustrate this point. Author (NSA)

N71-28095# Joint Inst. for Nuclear Research, Dubna (USSR).
DOUBLE DIFFERENTIAL DISTRIBUTION OF PARTICLES PRODUCED IN THE PROTON NUCLEUS COLLISIONS
V. S. Barashenkov, A. S. Il'inov, N. M. Sobolevskii and V. D. Toneev 1970 14 p refs In RUSSIAN
(JINR-P2-5507) Avail: AEC Depository Libraries

The results of cascade calculations of the double differential distributions of particles, produced in the proton-nucleus collisions in the energy range from several dozens of MeV up to several GeV, are compared with experiment and the cross sections calculated by the Bertini method. In general, all these data agree well. The reasons for divergences are discussed in some details. Author (NSA)

N71-28096# Lyon Univ. (France). Institut de Physique Nucleaire.
APPLICATION OF SOFT PION THEOREMS TO NUCLEI
Magda Ericson 16 Mar. 1970 26 p refs Presented at the Conf. on High Energy Phys. and Nucl. Struct., Valencia, Mar. 1970
(LYCEN-7017; CONF-700333-1) Avail: AEC Depository Libraries

The validity of treating nuclei as elementary particles was investigated. The soft pion theorems, which relate processes involving the interaction of strongly interacting particles with weakly interacting particles, were used. It was found that in general the soft pion limit could be interpreted as the Born approximation for the reaction. There are some corrections to this picture arising from the composite structure of the nucleus, but they should not exceed 5 to 10%. The deviation of the physical amplitude from the soft pion limit is simply the distortion of the pion wave by the nucleus. It is remarkable that the nucleus can be treated as a whole and that in many cases its granular structure plays such a small role. NSA

N71-28097# Joint Inst. for Nuclear Research, Dubna (USSR).
SU(3) SYMMETRY AND STATISTICAL MODEL FOR MULTIPLE PARTICLE PRODUCTION
V. M. Maltsev 1971 10 p refs Submitted for publication
(JINR-E2-5599) Avail: AEC Depository Libraries

A simple method of parametrization of the SU(3) group is suggested. The projection of a physical state, containing an arbitrary number of octets and decuplets is represented by an integral over the parameter space of the symmetry group. Author (NSA)

N71-28098# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
SINGLE PARTICLE ENERGIES, THE SAXON-WOODS POTENTIAL FOR WAVE FUNCTIONS, AND LEVELS OF ODD PARITY NUCLEI OF ACTINIDES
F. A. Gareev, S. P. Ivanova, L. A. Malov, and V. G. Solov'ev 1970 54 p refs In RUSSIAN
(JINR-P4-5470) Avail: AEC Depository Libraries

The single particle state of the Saxon–Woods potential for A = 239 and A = 247 was described and energies and wave functions for a series of odd nuclei were calculated taking into account the pair correlations of interactions of superconducting type quasi-particles with phonons. A method is given for resolving Schroedinger equations with Saxon–Woods potential. The behavior of single particle levels in the A = 239 and A = 247 zones was analyzed and properties of their wave functions are discussed. A calculation method for energy and wave functions of nonrotational states of odd-parity nuclei is described, and energies and the largest components of wave functions for ground and excited states of a series of odd nuclei in the region of 235 < or = to A < or = to 249 were found. NSA

N71-28099# Aerospace Corp., El Segundo, Calif. Lab. Operations.
LYMAN-ALPHA EMISSION CROSS SECTIONS FOR COLLISION OF H(PLUS) AND H WITH N2 AND O2
John H. Birely and R. J. McNeal 15 Feb. 1971 39 p refs
(Contract F04701-70-C-0059)
(AD-721462; TR-0059(9260-01)-12; SAMSO-TR-71-59) Avail: NTIS CSCL 7/4

Cross sections are reported for the emission of Lyman-alpha radiation in collisions of beams of 1 - 30 keV H(+) and H with thin targets of N2 and O2. The observed emission cross sections yield the cross sections for population of H(2p) in electron capture collisions of the protons and in excitation collisions of the hydrogen atoms after small corrections for polarization and cascade effects. Application of an electric field of several hundred V/cm in the collision chamber causes the light emission to be enhanced, owing to radiative quenching of metastable H(2s), and the maximum contribution to emission of auroral Lyman-alpha from production of H(2s) can be assessed. The results show that collisional excitation of fast hydrogen atoms rather than electron capture by protons is the major mechanism for H(2s) and H(2p) production in the aurora. Consideration of the ratio of the cross sections for producing H(2s) and H(2p) and of the possible collisional quenching processes for H(2s) leads to the conclusion that the major contribution to auroral Lyman-alpha in the 1 - 30 keV energy range is emission from hydrogen atoms collisionally excited to the 2p state. Author (GRA)

N71-28105# Argonne National Lab., Ill. Chemistry Div.
YIELDS OF FISSION PRODUCTS FOR SEVERAL FISSIONABLE NUCLIDES AT VARIOUS INCIDENT NEUTRON ENERGIES
K. F. Flynn and L. E. Glendenin Dec. 1970 32 p refs
(Contract W-31-109-eng-38)
(ANL-7749) Avail: NTIS

A summary is given of recommended values for fission product yields from fissioning systems pertinent to the physics of reactors based on a survey of the literature through October 1970. Recommended experimental and estimated values for total chain yields in the form of tables and mass-yield curves are presented for neutron-induced fission of Th-232, U-233, U-235, U-238, Pu-239, and Pu-241 at various neutron energies. Author (NSA)

N71-28110# Syracuse Univ., N.Y. Dept. of Physics.
FIXED POLE MODELS FOR THE POMERANCHUKON
R. F. Amann Nov. 1970 13 p refs Sponsored by AEC
(SU-1206-239; NYO-3399-239) Avail: NTIS

Fixed pole models, made consistent with crossed channel unitarity by the addition of a shielding cut, are shown to factorize and, therefore, to be an eligible model for the Pomeranchukon. Their phenomenological implications are explored; and, if the branch point of the shielding cut becomes complex, the combined pole plus cut entity is shown to provide an acceptable explanation of the Serpuchov data. Author (NSA)

N71-28111# California Univ., Livermore. Lawrence Radiation Lab.
ON THE NATURE OF HADRON ROTATIONAL LEVELS
Malcolm H. MacGregor 2 Feb. 1971 18 p refs Presented at the Conf. on Fundamental Interactions at High Energy, Coral Gables, Fla., Jan. 1971 Submitted for publication Sponsored by AEC Revised
(UCRL-72943-Rev-1; CONF-710106-4-Rev-1) Avail: NTIS

It is demonstrated that it appears possible to use a nuclear physics approach in the classification of nucleon and hyperon resonances if account is taken of rotational systematics. The S state nucleon excitation levels, and rotational bands for the nucleon and hyperon resonances are shown. NSA

N71-28112# Los Alamos Scientific Lab., N.Mex.
ENERGY LOSS BY NUCLEAR ELASTIC SCATTERING
Joseph J. Devaney and Myron L. Stein Oct. 1970 12 p refs
(Contract W-7405-eng-36)
(LA-4543) Avail: NTIS

The rate of energy loss suffered by a heavy charged particle from nuclear force elastic scattering, plus nuclear Coulomb interference, is derived, and the rate for protons, deuterons, and alphas in deuterium is given as a function of incident energy. Author (NSA)

N71-28113# Reactor Centrum Nederland, Petten.
THEORETICAL AND EXPERIMENTAL STUDY OF A FAST-THERMAL COUPLED REACTOR BY CORRELATION TECHNIQUES
Abdi Dalfes (Tech. Univ. of Istanbul), Erdinc Tuerkcan, and Jan B. Dragt Nov. 1970 45 p refs
(RCN-132) Avail: AEC Depository Libraries

The model proposed by Avery to predict the kinetic behavior of coupled reactors in the mean sense, is extended to the determination of the correlation functions between counts given by neutron detectors located in the zones. The agreement between theoretical and experimental results confirms this model. Experiments show that the fast-thermal coupled STEK-4000 core behaves as a two-point reactor for delay times of the order of microns. The correlation functions are measured on-line with a small digital computer. Author (NSA)

N71-28114# Japan Atomic Energy Research Inst., Tokyo.
ANALYSIS OF JMTR FLUX VARIATION DURING OPERATION
Toshiyuki Tanaka, Tatsuro Omura, and Toru Fukuda Aug. 1970 53 p In JAPANESE; ENGLISH summary
(JAERI-4130) Avail: AEC Depository Libraries

Neutron flux variation during reactor operation with small size cores is influenced by reactor control rod position change, fuel burnup, etc. In order to solve this problem in JMTR, attention is paid to shim rod arrangement and the withdrawal sequence. The analysis of neutron flux change and the variational effects in irradiation holes are calculated. These results are compared with those of in-core irradiation experiments and JMTR physics experiments for their evaluation. The calculational model is accurate and JMTR neutron flux variation is at most from 10 to 20% in ordinary irradiation holes. If attention is paid to Xe buildup processes, the variational factor is about 10%. Author (NSA)

N71-28118# Kernforschungsanlage, Juelich (West Germany).
MODERATION OF FAST NEUTRONS IN POLYETHYLENE AND THEIR USE IN NEUTRON DOSIMETRY [UEBER DIE MODERATION SCHNELLER NEUTRONEN IN POLYAETHYLEN UND IHRE ANWENDUNG IN DER NEUTRONENDOSIMETRIE]
F. Rohloff and M. Heinzelmann 22 Jul. 1970 172 p refs In GERMAN
(EUR-4540D) Avail: AEC Depository Libraries

An improvement in neutron field measurement (fluence and equivalent dose power) by means of moderator balls is suggested. The spatial distribution of the flux density of the thermal neutrons in the moderator is used for the measurement. To arrive at the measured value, use is made of both the counting rates at the center of the various balls, and also the counting rates at different points in a single ball. By this means a compact counter is produced in which the indications are independent of direction. Lithium fluoride thermoluminescent dosimeters were used. Author (NSA)

N71-28120# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
ON SOME POSSIBILITIES OF SOLVING THE FADDEEV EQUATIONS WITH THE POTENTIALS OF ARBITRARY FORMS
V. B. Belyaev and A. L. Zubarev 1970 13 p refs In RUSSIAN
(JINR-P4-5510) Avail: AEC Depository Libraries

Some practical potentialities of the separable expansion of partial harmonics of the nucleon–nucleon potential V(K,K') of an arbitrary form are considered. Such factorization appears to be the most effective for the square well potential and for potential with the infinite repulsion at small distances. The separable representations of potential V(K,K') are also discussed. The proof of the uniform convergence of Beitmans' expansion is given. Author (NSA)

N71-28143# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions.
EVIDENCE FOR PARTICLE INSTABILITY OF He 10
A. G. Artukh, V. V. Avdeichikov, G. F. Gridnev, V. L. Mikheev, V. V. Volkov et al 1970 14 p refs
(JINR-E7-5492) Avail: AEC Depository Libraries

The cross section for He-10 production in the reaction Th-232 (N-15 minus 5 protons) yields He-10 at E lab (N-15) = 145 MeV was estimated from the systematics of the cross sections for multi-nucleon transfer reactions. In the experiment, in which, assuming the particle stability of He-10, about 80 He-10 events should be expected, not even a single one has been observed. This result is interpreted as evidence for particle instability of He-10. Author (NSA)

N71-28157# Los Alamos Scientific Lab., N.Mex.
ANGULAR DISTRIBUTIONS AND CORRELATIONS OF RADIATION EMITTED FROM ORIENTED NUCLEI
R. M. Steffen Nov. 1970 168 p refs
(Contract W-7405-eng-36)
(LA-4565) Avail: NTIS

An introduction is given to the general theory of angular correlation phenomena. Symmetry is stressed, and the type of information obtainable from the observation of angular correlation phenomena is pointed out. A description of the ensemble of oriented particles, angular distribution of nuclear radiation emitted from oriented nuclei, angular correlations of two successively emitted radiations, angular distribution and orientation coefficients, and angular distribution coefficients for electromagnetic radiation are discussed. Angular distribution and orientation coefficients for conversion electrons, alpha particles, and beta particles, and extranuclear perturbations of angular distributions and correlations are also treated. NSA

N71-28164# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Serpukhov (USSR). Inst. Fiziki Vysokikh Energii.
HIGH PRESSURE GAS TARGET COOLED BY LIQUID NITROGEN [GAZOVAYA MISHEN VYSOKOGO DAVLENIYA S AZOTNYM OKHLAZHDENIEM]
S. P. Denisov, A. N. Nekresov, D. A. Stoyanova, and V. V. Sytnik 1970 28 p refs In RUSSIAN
(IFVE-SEF-70-22) Avail: AEC Depository Libraries

A 3 m gas target for work with hydrogen, deuterium, and

helium at pressures up to 75 atm and at the temperature of boiling liquid nitrogen (T = 78 K) is described. The target is used for the experiments at the 70 GeV accelerator. The gas densities of 7.5 g/sq cm for H2, approximately 15 g/sq cm for D2, and approximately 13 g/sq cm for He can be achieved. The accuracy of the density determination is approximately 0.5% for H2 and He, and approximately 0.7% for D2. The full thickness of the windows is 2 g/sq cm. Author (NSA)

N71-28165# Texas A&M Univ., College Station. Cyclotron Inst.
ANGULAR MOMENTUM EFFECTS IN NUCLEAR REACTIONS Progress Report, 1 Jan. – 31 Dec. 1970
J. B. Natowitz [1970] 10 p refs
(Contract AT(40-1)-3924)
(ORO-3924-5) Avail: NTIS

Angular momentum effects in nuclear reactions with emphasis on the probability of compound nucleus formation and the evaporation of alpha particles in the de-excitation of Te-120 were studied. Fission isomerism and alpha decay in the neutron deficient Am isotopes were also investigated. The first chance fission of Hg-198 was explored by the measurement of fission fragment angular distributions from the reaction Au-197(p,f). The division of the available kinetic energy between neutrons and gamma rays in the reactions Nb-93(alpha,2n)Tc-95 and Nb-93(alpha,3n)Tc-94 was determined. Related research on a study of the reaction Bi-209(alpha,p)Po-212,m,g is summarized briefly as is collaborative research in the area of X-ray emission induced by charged particles. An appendix presents the ratios of X-ray yields from the irradiation of Ti, Cu, and Au targets with alpha particles and deuterons of identical velocity between 6.25 and 20 MeV/amu. Author (NSA)

N71-28169# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Lab. Nazionali di Frascati.
ADONE DEVICE: PRESENT STATUS AND OPERATION
22 Oct. 1970 14 p refs Presented at the Informal Meeting on Electron and Positron Storage Rings, Frascati, 1970 *Its* Note No. 493
(LNF-70/48) Avail: AEC Depository Libraries

Starting December 10, 1969, Adone has been running for experiments with head-on collisions and beam energies up to 1200 MeV. Four experiments are running at a time. The present energy limitation is due to the fact that two of the four RF cavities have not been installed yet. Installation of full RF power is scheduled to begin at the end of this year or around February 1971. Beam energies of 1500 MeV will then be available. At the high energy side of the working range the design values of luminosity have been obtained. Operation data are tabulated. Author (NSA)

N71-28170# New Mexico State Univ., Las Cruces. Dept. of Physics.
DECAY RATE AND BRANCHING RATIO (PION(MINUS) He 3)/(ALL PION(−) MODES) OF HYPERTRITON
B. Ram and W. Williams [1970] 12 p refs
(TID-25665) Avail: NTIS

The total decay rate and branching ratio R3 were calculated, using spatial wave functions for He-3 and the hypertriton obtained on the basis of their variational calculations of these systems in terms of nucleon nucleon and Lambda hyperon nucleon potentials with hard cores. The results are about the same as those previously obtained using wave functions without hard core distortions. Author (NSA)

N71-28195# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
TABLES OF THE WAVE FUNCTIONS OF THE SINGLE PARTICLE STATES OF THE TRANSURANIUM REGION DEFORMED NUCLEI IN THE SAXON–WOODS POTENTIAL
F. A. Gareev, S. P. Ivanova, and N. Yu. Shirikova 1970 47 p refs In RUSSIAN
(JINR-P4-5457) Avail: AEC Depository Libraries

Tables of the energies and wave functions of nuclei in the region of 230 < A < 250 are listed. Author (NSA)

N71-28210*# Techtran Corp., Glen Burnie, Md.
EVALUATION IN THE RESONANCE RANGE OF NUCLEI WITH THE MASS NUMBER ABOVE 220 [EVALUATION DANS LE DOMAINE DES RESONANCES POUR LES NOYAUX DE NOMBRE DE MASSE SUPERIEUR A 220]
P. Ribon Washington NASA Jun. 1971 35 p refs Transl. into ENGLISH from the publ. 'Nuclear Data for Reactors, Volume 1' Vienna, IAEA, 1970 p 571–598 Presented at 2d Intern. Conf. on Nucl. Data for Reactors, Helsinki, 15–19 Jun. 1970; sponsored by IAEA
(Contract NASw-2037)
(NASA-TT-F-13692) Avail: NTIS CSCL 20H

The problems posed by the evaluation of neutron data for fissile or fertile nuclei in the range of resolved or unresolved resonances are discussed. Author

N71-28211# California Univ., Livermore. Lawrence Radiation Lab.
FINE STRUCTURE CONSTANT ALPHA EQUALS e sq/hc AS A UNIVERSAL SCALING FACTOR
Malcolm H. MacGregor 15 Jan. 1971 6 p refs Presented at Conf. on Fundamental Iteractions at High Energy, Coral Gables, Fla., 20 Jan. 1971
(UCRL-72955; CONF-710106-5) Avail: NTIS

A phenomenological relation is established between the fine structure constant and leptonic and gravitational processes. NSA

N71-28212# Institute of Nuclear Research, Warsaw (Poland).
MINIGASKET: A CODE FOR THERMAL NEUTRON SCATTERING LAW IN POLYCRYSTALS
Jacek Arkuszewski 1970 124 p refs
(INR-1186) Avail: AEC Depository Libraries

This computer code is patterned on part of the general atomic code GASKET, which pertains to two dynamical modes of the scattering system: isotropic harmonic vibration with continuous frequency spectrum and free translation. The scattering law S(alpha,beta) for such a system is calculated in incoherent approximation by direct numerical Fourier transformation from the intermediate scattering function averaged over the monatomic polycrystal. Some improvements are introduced to the GASKET numerical procedure. The scattering-law calculations for the continuous component of the Haywood phonon distribution function for H bound in H2O is included. The code is written in ALGOL for the GIER computer. Author (NSA)

N71-28223*# Techtran Corp., Glen Burnie, Md.
MEASURING DURATION TIME BY SURFACE TESTS [METING VAN DEN VERBLIJFTIJD UIT MEEVOERINGSPROEVEN]
P. Clausing Washington NASA May 1971 20 p refs Transl. into ENGLISH from Physica (Utrecht), v. 8, 1929 p 289–304
(Contract NASw-2037)
(NASA-TT-F-13669) Avail: NTIS CSCL 20H

The possibility of molecules condensing and/or remaining on a smooth surface before being reflected is investigated. Apparatus was constructed to measure the average life of cd molecules on glass, piceine, mica, and copper. It was discovered that the coefficients of accommodation for Cd on piceine, mica, and Cu are approximately equal to unity and that 10 to the 12th power sec > average molecule life on surface > 1 million sec for Cd on these layers at temperatures in the neighborhood of 200 K. Author

N71-28226# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
REGULARITIES OF THE ISOTOPE IN THE MULTINUCLEON TRANSFER REACTIONS
Yu. Ts. Oganesyan, Yu. E. Penionzhkevich, and A. O. Shamsutdinov 1970 26 p refs In RUSSIAN
(JINR-P7-5495) Avail: AEC Depository Libraries

The experimental results on studying the yields of the products from the multinucleon transfer reactions on the Au, Pb, and Bi nuclei, while bombarded with the C-12, Ne-22, and Ar-40 ions, are presented. The angular distributions of some transfer reaction products and the spectra of their kinetic energies were also studied. On the basis of the data obtained, several conclusions are drawn on the mechanism of the multinucleon transfer reactions and qualitative consideration of this mechanism is given. Author (NSA)

N71-28229# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Lab. Nazionali.
ADONE OPERATION REPORT, 1 JANUARY–31 DECEMBER 1970
M. Placidi, G. Cocco, M. Vescovi et al Dec. 1970 6 p
(LNF/AOR-1) Avail: NTIS

Operation data are presented including machine time dedicated to high-energy physics, nuclear physics, machine physics, machine shutdowns for modifications, and maintenance time. Linac operation is summarized. NSA

N71-28230# Oak Ridge National Lab., Tenn. Neutron Physics Div.
CROSS SECTIONS FOR HYDROGEN AND HELIUM PARTICLES PRODUCED BY 62- AND 39-MeV PROTONS ON Bi 209
F. E. Bertrand and R. W. Peelle Jan. 1971 70 p refs
(Contract W-7405-eng-26)
(ORNL-4638) Avail: NTIS

Cross sections are presented for the production spectra of proton, deuteron, triton, helium-3, and alpha particles from Bi-209 bombarded by 62-MeV protons, and, for all particles but He-3, for incident 39-MeV protons. Continuum cross sections in approximately 1-MeV bins are listed for 18 angles for 62-MeV incident protons, and for four angles for 39-MeV protons. The low-energy cutoffs range from 4 to 15 MeV for the different exit particle types. Angular distributions for 62-MeV incident protons are given for various excitations in Bi-209. The energies, strengths, and angular momentum transfers obtained for the Bi-209 collective groups approximate those for the collective levels of Pb-208. In Bi-209 angular distributions are given for multiplets observed with 62-MeV protons at excitation various energies. Elastic scattering cross sections are given for incident 38.8-MeV protons. Definite evidence is found for (proton, neutron antiproton) reactions in the 90-deg proton spectrum for 39-MeV incident protons, and a value for the Pb-209 to Bi-209 Coulomb displacement energy of 18.9 + or − 0.1 MeV is obtained from these data. Author (NSA)

N71-28238# Teledyne Isotopes, Westwood, N.J.
ISIS: A PROGRAM FOR COMPUTERIZED FISSION DATA ANALYSIS
Peter Alexander, David Lightbody, Carl Hansen, and Waldo A. Patton (Columbia Univ.) 30 Nov. 1970 105 p refs
(Contract DASA01-69-C-0057)
(AD-721481; IWL-7909-217) Avail: NTIS CSCL 18/7

A two part computer program has been written to aid in the analysis and interpretation of experimental fission data. The first part of the program calculates the population of all members of any radioactive decay chain at any point in time using as input the initial population distribution and the structure of the decay chain. The program may also be used to perform a time integration of the population for any member to give the number of decays during a specified time interval. The second part of the program uses as input the experimentally measured yield values derived from extractions at various times after fission of one or more members of a particular fission product decay chain. The independent fission yield to any given mass chain is assumed to be distributed according to a Gaussian function. The parameters Z sub P and w characterizing this distribution are varied so as to minimize the quantity Chi squared which is based on the difference between the calculated and experimentally determined fission yield values. Author (GRA)

N71-28239# Joint Inst. for Nuclear Research, Dubna (USSR).
MODEL-INDEPENDENT ANALYSIS OF THE FORWARD PION(+ OR −) PROTON SCATTERING DATA
O. V. Dumbrais and N. M. Queen 1971 8 p refs Submitted for publication
(JINR-E2-5561) Avail: AEC Depository Libraries

A new method is used to analyze the experimental data on forward elastic pion(+ or −) scattering in a model-independent way. The analysis yields a value for the pion NN coupling constant, values of parameters describing the asymptotic behavior of the amplitudes, and an accurate prediction of the real parts of the amplitudes at moderate energies. Author (NSA)

N71-28273# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).
FITS TO ELECTROPRODUCTION DATA IN THE RESONANCE REGION AND CONSEQUENCES FOR sigma sub 1/sigma sub t
F. W. Brasse, W. Fehrenbach, W. Flauger, K. H. Frank, J. Gayler et al Jan. 1971 22 p refs
(DESY-71/2) Avail: AEC Depository Libraries

All published measurements of electroproduction cross sections, where only the scattered electron was detected, were used to get some information for the ratio sigma sub 1/sigma sub t in the resonance region. The experimental cross sections were fitted in the absolute value of the three momentum transfer independently for small bins of W across the range 1.11 < or = to W < or = to 1.99 GeV. This was made for two ranges of the polarization Epsilon of the virtual photon. In one range Epsilon was restricted to Epsilon > or = to 0.9, in another one to Epsilon < or = to 0.6. By comparing cross sections resulting from these fits for the two ranges of Epsilon, but for the same values of q(2) and W, a significant sigma sub 1 contribution is not found. Taking into account the size of errors, upper limits can be put on R = sigma sub 1/sigma sub t. These are about R < or = to 0.2 for 0.5 < or = to q(2) < or = to 2.0 (GeV/c)(2) and R < or = to 0.35 for 2.0 < q(2) < or = to 4.0 (GeV/c)(2) over the whole range of W as indicated above. Author (NSA)

N71-28311# Purdue Univ., Lafayette, Ind. Dept. of Physics.
EVIDENCE AGAINST A NEUTRON PION(−) PION(−) ENHANCEMENT AT A MASS OF 1.627 GeV/c sq IN KAON(−) DEUTERON YIELDS SPECTATOR PROTON PION(+) PION(−) PION(−) NEUTRON ANTIKAON(0) AT 4.48 GeV/c
A. C. Ammann, D. D. Carmony, A. F. Garfinkel, L. J. Gutay, D. H. Miller et al [1970] 5 p refs Sponsored in part by AEC
(COO-1428-255) Avail: NTIS

Recently evidence was presented for the production of a neutron pion(−) pion(−) enhancement of mass 1627 MeV/c sq in the reaction kaon(−) deuteron yields spectator proton pion(+) pion(−) pion(−) neutron antikaon(0). With greater statistics, the data for the same reaction at nearly the same energy fail to show any evidence for such a resonance. Author (NSA)

N71-28312# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
X(0)(960) MESON: 2(−) OR 0(−)
V. I. Ogievetskii, W. Tybor, and A. N. Zaslavskii 1971 9 p refs

(JINR-E2-5627) Avail: AEC Depository Libraries

It is shown that the available experimental data are equally consistent with the spin-parity 0(−) and 2(−) of the X(0) (960) meson. 2(−) seems to be somewhat preferable. Both spin-parity alternatives and new experiments to distinguish between them are discussed. Author (NSA)

N71-28438# Technische Hogeschool, Delft (Netherlands). Afdeling der Technische Matuurkunde.

ADSORPTION AND CAPILLARITY

John Carel Peter Broekhoff (Ph.D. Thesis) Jun. 1969 237 p refs

Avail: NTIS

A general theory of the role of adsorption in capillary condensation and evaporation phenomena is developed and applied to the analysis of experimental data on the retention of capillary condensed liquids by small pores in rigid solids. General equations are developed and applied to the interpretation of nitrogen adsorption isotherms. It is shown that actual porous systems can be analyzed in terms of simple geometric pore models. The developed theory is applied to scanning phenomena in physical adsorption. ESRO

N71-28439# Paris Univ. (France).

STUDY OF INTERATOMIC SPECTRA OF SOME RARE GAS/METAL ALKALI COUPLES [ETUDES DU SPECTRE INTERATOMIQUE POUR QUELQUES COUPLES ALCALIN/GAZ RARE]

Francoise Besombes (Ph.D. Thesis − CNRS, Bellevue, France) 1970 82 p refs In FRENCH

Avail: NTIS

Interatomic spectra associated with Rb 5D-4D, Cs 6S-5D, and Rb 5S-5D forbidden transition are investigated. Emphasis is made on the study of perturbing satellite bands due to the presence of rare gases. It is shown that these additional bands are a characteristic of the alkali metal/rare gas pair. ESRO

N71-28487# Joint Publications Research Service, Washington, D.C.

DOSIMETRIC MEASUREMENTS ABOARD A SPACESHIP USING NUCLEAR EMULSIONS

V. A. Blashkovskiy *In its* Space Biol. and Med., Vol. 5, No. 2, 1971 24 Jun. 1971 p 71−75 refs (See N71-28476 16-04)

Avail: NTIS

The use of nuclear emulsions in dosimeters for determining space radiation insensity in Soyuz 3 spacecraft is discussed. A peculiarity of extraterrestrial radiation is that the quality factor can differ from unity. In order to determine the tissue dose it is necessary to analyze the composition of the ionizing radiations. This is accomplished by the nuclear emulsion dosimeters consisting of BR-2 rectangular layers 400 microns thick with linear measurements of 35 by 45 millimeters. Author

N71-28566# Atomic Energy Commission Research Establishment, Riso (Denmark).

PHYSICS DEPARTMENT Semiannual Report, 1 Jan. −30 Jun. 1970

H. Bjerrum Moeller and C. J. Christensen Oct. 1970 18 p refs

(RISO-M-1300) Avail: AEC Depository Libraries

The research work of the department covers the following main fields: Neutron physics (solid-state investigations), plasma physics, nuclear spectroscopy, radiation damage, and meteorology. The main activities are described. Author (NSA)

N71-28600# Naval Postgraduate School, Monterey, Calif.

DESIGN AND CONSTRUCTION OF AN APPARATUS TO MEASURE THE EXCITATION CROSS SECTIONS OF MOLECULAR NITROGEN WHEN BOMBARDED BY LOW ENERGY ELECTRONS

Winfred Dan Vallance (M.S. Thesis) Mar. 1971 24 p refs

(AD-721579) Avail: NTIS CSCL 7/4

An apparatus was designed and constructed to measure the absolute cross sections for forming the B doublet Sigma(u)(+) state of N2(+), which gives rise to the first negative band system of N2(+); and the C triplet pi(u) state of N2, which gives rise to the second positive band system of N2, in the lowest vibrational energy level when gaseous molecular nitrogen is bombarded by electrons in the energy range 50 eV to 2,000 eV. The machine was constructed such that the reaction rate will be measured by counting the photons from the electromagnetic decay of these states while the gas is in a steady state condition. Author (GRA)

N71-28636*# Maryland Univ., College Park. Dept. of Physics and Astronomy.

EXPERIMENTAL RATE COEFFICIENTS FOR COLLISIONAL EXCITATION OF LITHIUM-LIKE IONS

H.-J. Kunze and W. D. Johnston, III [1971] 32 p refs Sponsored in part by AEC

(Grant NGL 12-002-008)

(NASA-CR-119017) Avail: NTIS CSCL 20H

Collisional excitation rates in N5, O6, and Ne7 were derived from absolute line intensities emitted by these ions in a well diagnosed plasma. The plasma was produced in a theta pinch device, and several plasma conditions were investigated. Electron density and temperature were obtained as a function of radius and time from the spectrum of scattered laser light. Although the accuracy of the individual rate coefficients is a factor of 2 only, the rms deviation of the experimental values from the theoretical ones is about 10% for excitation to the n = 2 and n = 3 levels and about 15% for excitation to the 4s level. The rates to the 4p and 4d levels are on the average approximately 60% of the theoretical ones. Author

N71-28637*# Maryland Univ., College Park. Dept. of Physics and Astronomy.

COLLISIONAL IONIZATION RATES FOR LITHIUM AND BERYLLIUM-LIKE IONS

H.-J. Kunze [1971] 22 p refs Sponsored in part by NAVY

(Grant NGL-21-002-008)

(NASA-CR-119018) Avail: NTIS CSCL 20H

Collisional ionization rates for C4, N5, and O6 as well as for O5 and Ne7 are deduced from the time history of spectral lines emitted by these ions in a hot plasma. The plasma (in the electron temperature range 100 eV to 260 eV) is produced in a 15 kjoule theta pinch device, and it is analyzed using the light scattering technique. The results are consistent with theoretical calculations for O6, and with a semiempirical formula based on theoretical calculations for hydrogenic ions but smaller by factors 1.5 - 2. Author

N71-28638# Colorado Univ., Boulder.

THEORY OF ELEMENTARY PARTICLE AND NUCLEAR PHYSICS Final Report, 1 Oct. 1966 −30 Sep. 1968

Joseph Dreitlein Mar. 1971 7 p refs

(Contract N00014-67-A-0405-0001)

(AD-721724) Avail: NTIS CSCL 20/8

A summary of the research project in particle physics is presented. The topics include group theoretical studies, kinematical investigations, Regge poles and current algebras. Author (GRA)

N71-28713# Idaho Nuclear Corp., Idaho Falls.

DEVELOPMENTS IN NEUTRON-SCATTERING AT THE MTR

R. M. Brugger *In* IAEA Instrumentation for Neutron Inelastic Scattering Res. 1970 p 197 - 210 refs (See N71-28701 16-14)

Avail: NTIS

Development of several new pieces of equipment and several new methods for neutron scattering is reported. These developments include samples at high pressures, detection of molecular vibrations,

use of correlation choppers, small digital computer interfacing and intense sources. Author

N71-28714# Joint Inst. for Nuclear Research, Dubna (USSR).
SOME PROBLEMS OF NEUTRON SPECTROSCOPY AT PULSED SOURCES
N. Kroo *In* IAEA Instrumentation for Neutron Inelastic Scattering Res. 1970 p 211–223 refs (See N71-28701 16-14)
Avail: NTIS

The study of the dynamics of condensed systems requires higher and higher neutron intensities. Of great importance in this respect are pulsed neutron sources, since they offer a very high flux during the short time interval of the neutron burst. Due to the relatively long pulses available from a pulsed reactor, especially for cold neutrons, further tailoring of the neutron beams is required in order to get a reasonable resolution for inelastic slow neutron scattering studies. The simplest solution to this problem can be achieved by using mechanical choppers phased with the reactor to shorten the neutron pulses. This method leads to big losses in neutron intensity. One possible way to reduce these losses might be the combination of the correlation and classical pulsed time-of-flight methods. The advantages of a spectrometer working on the basis of this combined principle are shown and a possible way of realization is described. Author

N71-28716# United Kingdom Atomic Energy Authority, Harwell (England). Materials Physics Div.
REVIEW OF HOT NEUTRON SOURCES
P. A. Egelstaff *In* IAEA Instrumentation for Neutron Inelastic Scattering Res. 1970 p 249–268 refs (See N71-28701 16-14)
Avail: NTIS

The principles for the design and construction of hot neutron sources in conventional reactors are reviewed and existing neutron sources are described. Sources made of beryllium oxide and graphite have been put into practical use and the performance of these sources is considered. The uses of hot sources are discussed and it is concluded that with present fluxes their use is limited. However, a wider field of application for hot neutron sources seems likely with the advent of high flux beam reactors. Author

N71-28744# Southern Illinois Univ., Carbondale. Materials Science Lab.
X-RAY DIFFRACTION STUDIES OF ELECTRON POLARIZATION IN FERROELECTRICS Final Scientific Report, 1 Dec. 1968–15 Dec. 1970
Marisa Canut-Amoros 15 Dec. 1970 147 p refs
(Grant AF-AFOSR-832-67)
(AD-722087; AFOSR-TR-71-0905) Avail: NTIS CSCL 20/12

Electron polarizability in ferroelectrics is studied via a new method developed by the principal investigator. The method, selected electron shell method, allows the independent study of the true electron density of the inner and outer electrons of atoms in crystals. By this method it is expected to get true information about effective electron density as a function of temperature in ferroelectrics. Special interest will be paid to the analysis of the electron polarizability in sodium nitrite, triglycine sulphate, barium titanate and other important ferroelectrics. A systematic study of the electron density of the outer and inner shell electrons will be done using x-ray diffraction data, especially in the neighborhood of the ferro-paraelectric transition. Theoretical models computed via convolution method will be compared with experiments. The knowledge gained will increase the understanding of the fundamentals behind the phenomenon of ferroelectricity in solids, and facilitate the design of ferroelectric devices. Author (GRA)

N71-28812# Joint Inst. for Nuclear Research, Dubna (USSR).
SPACE DISTRIBUTION OF THE ALPHA CLUSTERS IN THE LIGHT NUCLEI
O. B. Abdinov and V. S. Barashenkov 1970 8 p refs In RUSSIAN
(JINR-P4-5479) Avail: AEC Depository Libraries

Those characteristics of particles (produced in high-energy interactions of protons with carbon nuclei) that are the most sensitive to the form of the space distribution of alpha clusters are studied in the framework of the intranuclear cascade model. The angular distribution of the resulting alpha particles is one of those features which depends weakly on other cascade-model parameters. The analysis of experimental data obtained at 660 MeV shows that the model with peripheral distribution is the most preferable; however, more accurate measurements must be performed to draw more detailed conclusions on this point. Author (NSA)

N71-28813# Army Mobility Equipment, Research and Development Center, Fort Belvoir, Va.
NUCLEAR MAGNETIC RESONANCE STUDIES OF MOLECULAR INTERACTIONS AT PHASE INTERFACES
James V. Mengenhauser Mar. 1971 15 p refs
(AD-722232; USAMERDC-2002) Avail: NTIS CSCL 7/4

The high-resolution NMR spectra of water adsorbed on pyrogenic alumina, silica and titania were taken at coverages of approximately 2 to 16 layers. The water line widths were 280 to 300 Hz on alumina, 60 to 90 Hz on silica, and 50 to 110 Hz on titania. The chemical shift of water adsorbed on alumina and silica was relatively constant as a function of coverage, while the water line on titania shifted 0.4 ppm downfield as the coverage decreased from 16.1 to 2.3 layers. Because the NMR spectra of liquids adsorbed on solids are complicated by inhomogeneous broadening and chemical exchange, it was concluded that NMR line widths and chemical shifts are not related to the molecular interactions in any simple fashion. For this reason, NMR spectroscopy is not recommended as a reliable method of selecting solid media to improve coalescence of emulsions. Author (GRA)

N71-28814# European Organization for Nuclear Research, Geneva (Switzerland).
MODERN PHYSICS FROM AN ELEMENTARY POINT OF VIEW
V. F. Weisskopf 17 Mar. 1970 26 p refs
(CERN-70-8) Avail: AEC Depository Libraries

Various aspects of atomic and molecular physics are discussed. The theory starts with a single hydrogen atom and extends to solids. The various properties of cold and hot stars are also covered in a lecture. NSA

N71-28815# Junta de Energia Nuclear, Madrid (Spain).
DOUBLE EMISSION OF LAMBDA HYPERONS IN THE KAON(−) OF 6 GeV/c INTERACTIONS WITH NUCLEUS OF PHOTONUCLEAR EMULSION
A. F. Tejerina Garcia 1970 27 p refs In SPANISH
(JEN-217-IFIC/I-4) Avail: AEC Depository Libraries

The interactions with three or more centers, produced by negative kaon of 6 GeV/c with nucleus of photonuclear emulsion are analyzed. The analysis of one event with three centers was consistent with the formation and decay of double hyperfragment. Another event of three centers was analyzed as produced by the formation and decay of the cascade hyperfragment Xi hyperon B-11, the binding energy of cascade hyperon is B Xi hyperon = 9.2 + or − 2.2 MeV. Author (NSA)

N71-28816# Joint Inst. for Nuclear Research, Dubna (USSR).
MONTE CARLO GENERATION OF THE NEUTRAL PION(−) PROTON INTERACTIONS AT 5 GeV/c IN THE PROPANE BUBBLE CHAMBER
V. B. Vinogradov, G. Martinska, and L. Shandor 1970 23 p refs In RUSSIAN
(JINR-P13-5516) Avail: AEC Depository Libraries

The technique and the results of Monte Carlo generation

of neutral final states produced in the negative pion interactions at 5 GeV/c with the account of gamma-ray detection probability in the 1-meter JINR propane bubble chamber are presented. The results were used in determining the cross sections of reactions.
Author (NSA)

N71-28828*# Wisconsin Univ., Madison. Theoretical Chemistry Inst.
THE SPECTROSCOPY OF DIMERS
Howard B. Levine 15 Mar. 1971 128 p refs
(Grant NGL-50-002-001)
(NASA-CR-119028; WIS-TCI-432) Avail: NTIS CSCL 20H

Numerical calculations were made for a large number of models, and are given in the form of reduced spectral moments as functions of reduced temperature. From these tables, it is possible to make accurate estimates of the parameters of both the far infrared and Raman spectra of gaseous dimers in specific systems. The results show that for some systems, dimers make important although not necessarily well-separated contributions to the spectrum.
Author

N71-28878# California Inst. of Tech., Pasadena.
DILATION WIDTH, TENSOR-MESON DOMINANCE, AND BROKEN CONFORMAL INVARIANCE
R. J. Crewther [1971] 10 p refs Presented at Conf. on Fundamental Interactions at High Energy, Coral Gables, Fla., 20 Jan. 1971
(Contract AT(11-1)-68)
(CALT-68-295; CONF-710106-2) Avail: NTIS

The theory of the spontaneous breakdown of conformal and chiral symmetry is summarized. Conformal and chiral symmetry and collinear dispersion relations are discussed. It is concluded that the assumption of spontaneous violation of scale invariance does not conflict with the properties of the scalar meson sigma in the range of mass from 500 to 800 MeV.
NSA

N71-28879# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
METHOD OF SEARCHING FOR THE KINK AND DETERMINING THE TRACK PARAMETERS OF PARTICLES SCATTERED IN A BUBBLE CHAMBER
A. U. Abdurakhimov, E. N. Kladnitskaya, and Nguyen Din Thy 1970 19 p refs In RUSSIAN
(JINR-P1-5540) Avail: AEC Depository Libraries

A method is suggested for an effective search for the small angles of scattering in the particle track as well as the method of reconstruction of the track parameters taking scattering into account.
Author (NSA)

N71-28880# Pennsylvania Univ., Philadelphia. Dept. of Physics.
SELF CONSISTENT THEORY OF NUCLEAR SPECTRA: THE PAIRING PLUS QUADRUPOLE INTERACTION MODEL APPLIED TO THE TIN ISOTOPES
Gerard J. Dreiss, R. M. Dreizler, Abraham Klein, and G. Do Dang (Lab. de Phys. Theorique et Hautes Energies, Orsay, France) 4 Jan. 1971 33 p refs Supported in part by AEC
(UPR-0004N; NUB-2032; NYO-2171-335) Avail: NTIS

The equations of the self-consistent core-particle coupling method, or generalized Hartree – Fock approximation are derived for the special case of the pairing plus quadrupole-quadrupole interaction model. The bases of the approximations of this method are discussed along with the resolution of certain associated technical difficulties. Results of calculations for the tin isotopes which are completely self-consistent and satisfy all relevant physical constraints are presented. These results include the static quadrupole moments of the first 2(+) states of the even tin isotopes, energies of low-lying states of the odd tin isotopes and relative spectroscopic factors for (p,d) reactions on even targets.
Author (NSA)

N71-28884# Gulf Radiation Technology, San Diego, Calif.
CAGE-BIRD-SPEC: A PACKAGE FORTRAN 5 SYSTEM FOR THE REDUCTION AND ANALYSIS OF NEUTRON TIME-OF-FLIGHT SPECTRA
P. d'Oultremont, D. Houston, and J. C. Young 18 Nov. 1970 130 p refs
(Contract AT(04-3)-167)
(GULF-RT-10195) Avail: NTIS

Three FORTRAN 5 codes, namely CAGE, BIRD, and SPEC, which are used for the reduction and analysis of neutron time-of-flight spectra obtained in fast and thermal subcritical reactors, are described. Neutron time-of-flight spectra of subcritical reactors have to be corrected for neutron emission time and detector distortions as well as for the usual perturbations due to background and time analyzer dead time. All these corrections are performed by SPEC. This code reads the experimental data (signals and backgrounds), corrects them for the dead time of the recording system and then produces a net signal. As a second step, SPEC accepts a correction factor which, applied to the time-of-flight spectrum, removes the distortions due to neutron emission time and detector efficiency. Finally, SPEC edits the fully reduced data and the associated statistical error and groups them into the energy mesh requested by the user.
Author (NSA)

N71-28885# Stanford Linear Accelerator Center, Calif.
PRESENT STATUS AND FUTURE PLANS AT SLAC
R. B. Neal Nov. 1970 51 p refs Presented at 2nd Natl. Conf. on Particle Accelerators, Moscow, 11 Nov. 1970
(SLAC-Pub-802; CONF-701120-1) Avail: NTIS

The Stanford Linear Accelerator operations statistics are tabulated and recent accelerator improvements are outlined. Klystron experience and the status of the SPEAR (Stanford Positron-Electron Asymmetric Ring) are summarized. Future plans including higher power klystrons, possible improvements in duty cycle and beam energy, and the feasibility study for converting to a superconducting 100-GeV linac are discussed. The parameters of SPEAR and the parameters of a two-mile 100-GeV superconducting accelerator are listed.
NSA

N71-28918# United Kingdom Atomic Energy Authority, Harwell (England). Chemistry Div.
A LIBRARY OF NEUTRON INDUCED FISSION PRODUCT YIELDS MAINTAINED AND INTERROGATED BY COMPUTER METHODS. PART 1: THE ESTABLISHMENT OF THE LIBRARY
E. A. C. Crouch Dec. 1970 10 p refs
(AERE-R-6642-Pt-1) Avail: AEC Depository Libraries; HMSO 2s 6d; BIS $0.60

The first step towards objective assessment of fission product yields, susceptible to computer interrogation and maintenance. The organization of the compilation is explained.
Author (NSA)

N71-28919# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
STUDY OF (p,d) REACTIONS ON Sn 118 AND Sn 119 WITH POLARIZED PROTONS
J. L. Escudie, J. Gosset, H. Kamitsubo, R. Lombard, and B. Mayer 1970 2 p ref Presented at the 3d Intern. Symp. on Polarization Phenomena in Nucl. Reactions, Madison, Wis., 31 Aug. – 4 Sep. 1970
(CEA-CONF-1657; CONF-700911-10) Avail: AEC Depository Libraries

The cross sections and asymmetries were measured for the transitions to the ground state and the first five levels of Sn-117, and to the ground state and the first excited state of Sn-118. In the Sn-118(p,d)Sn-117 reaction, three transitions occur with l = 2; the j-dependence of the asymmetry for l = 2 is shown. The asymmetries for j = 3/2 are nearly always negative while the asymmetries for j = 5/2 are nearly always positive; the two curves are

in the phase opposition at forward angles. A D.W.B.A. calculation was performed with optical-potential parameters. These parameters were obtained by fitting the elastic scattering cross sections for both proton and deuteron channels and the polarization for elastic scattering in the proton channel. The agreement of D.W.B.A. predictions with the experimental results is impressive for the 1 = 0 transition. The fit is good for 1 = 2 transitions, but not so good for the asymmetries in 1 = 4 and 1 = 5 transitions although the oscillations are well reproduced. Author (NSA)

N71-28920# Georgia Univ., Athens. Dept. of Chemistry.
PHOTOELECTRON SPECTROSCOPY Progress Report, Fiscal Year 1970-1971
David M. Hercules 1971 17 p refs
(Contract AT(38-1)-645)
(SRO-645-1) Avail: NTIS

Research progress is reported on computerization of the magnetic spectrometer, a cryogenic probe, oxidation states of Mo compounds and compounds of Group VI elements, protonation sites, phosphonitrilic trimers, and ESCA spectra of metal chelates, including Na, Zn, Ag, Ba, Hg, La, Ni, and Th. NSA

N71-28938# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Experimentelle Kernphysik.
BETA-GAMMA (CP)-ASYMMETRY COEFFICIENTS IN ISOSPIN FORBIDDEN ALLOWED MIXED BETA TRANSITIONS
H. Behrens Jul. 1970 18 p refs Presented at the Intern. Conf. on Angular Correlations in Nucl. Disintegration, The Hague, 17-21 Aug. 1970
(KFK-1249) Avail: AEC Depository Libraries

During the past years a large amount of beta-gamma (CP)-asymmetry coefficients have been measured for mixed beta-transitions in which the Fermi matrix elements were isospin forbidden. In the following a compilation of all experimental results, their average for the different nuclei, the calculated Fermi matrix elements, isospin impurity coefficients and effective Coulomb matrix elements is given. Author (NSA)

N71-28956 Wisconsin Univ., Madison.
NUCLEAR MAGNETIC RESONANCE OF METAL ION COMPLEXES
Thomas Larry James (Ph.D. Thesis) 1969 278 p
Avail: Univ. Microfilms Order No. 70-3567

A nuclear magnetic resonance relaxation method was developed for investigating complex formation via measurements of the NMR spin-lattice relaxation rate of a quadrupolar nucleus with varying pH, metal ion concentration, and ligand concentration. Na-23 NMR spin-lattice relaxation times were measured for aqueous sodium ion solutions. The pH dependence of the Na-23 relaxation rate was used to indicate qualitatively the strength of sodium ion interactions with potential ligands, to identify the important coordinating groups and, in some cases, to demonstrate a chelate effect. Treatment of the Na-23 NMR relaxation data in a different manner permitted the study of sodium ion interactions with macromolecules. The pulsed NMR spectrometer was described emphasizing the modifications and use of a boxcar integrator for time-averaging of the NMR signal. Also included is an investigation of the proton affinities of neutral oxygen and sulfur in chelating ligands. Dissert. Abstr.

N71-28957 Michigan Univ., Ann Arbor.
PION AND PROTON PRODUCTION IN PROTON PROTON COLLISIONS AT 12.4 GeV/c
John Layton Day (Ph.D. Thesis) 1969 78 p
Avail: Univ. Microfilms Order No. 70-14497

The differential production cross section for pions and the differential inelastic cross section for protons were studied in proton proton collisions at 12.4 GeV/c. The cross sections for the pions were measured on lines of fixed P sub l and P2 in the center of mass while circules of fixed energy loss in the center of mass were used for the protons. There are two main features of our pion data. When the cross section d(2)delta/dOmegadp for the pion is plotted against P(2) perpendicular, there is a maximum at P sub l(cm) = 0 GeV/c which contradicts earlier evidence of a two center model of particle production. The second point is that a very sharp forward peak of the form e(-)15P sup 2 sub perpendicular appears in the P sub perpendicular dependence. A plot of the proton data shows the cross section to be a gaussian which is independent of the value of the circles of fixed energy loss. Dissert. Abstr.

N71-28964# Pittsburgh Univ., Pa. Wherrett Lab. of Nuclear Chemistry.
NUCLEAR CHEMISTRY RESEARCH Annual Report, Jan.-Dec. 1970
Robert L. Wolke Dec. 1970 36 p refs
(Contract AT(30-1)-2771)
(NYO-2771-40) Avail: NTIS

The charge states of recoils from nuclear reactions were studied and data were amassed on the angular distributions of the elastic B-10(d,d)B-10 and B-11(d,d)B-11 reactions. Developments are also reported in the production of ultrathin targets needed in the charge state work. Recoils from C-12(d,d)C-12, C-12(d,alpha)B-10, B-10(d,d)B-10, and B-11(d,d)B-11 reactions were investigated. NSA

N71-28981# Atomic Energy Establishment, Winfrith (England).
EFFICIENCY OF LI 6 GLASS SCINTILLATOR DETECTOR FOR FAST REACTOR SPECTRUM MEASUREMENTS
J. P. Hardiman Jan. 1970 21 p refs
(AEEW-M-898) Avail: AEC Depository Libraries; HMSO 5s/6d; BIS $1.10

The efficiency of a lithium glass detector, which is used in the measurement of fast neutron energy spectra of cores assembled in the zero energy fast reactor ZEBRA, has been measured relative to (1) a calibrated Harwell long counter using the pulsed Van de Graaff, IBIS, to produce monoenergetic neutrons and (2) the calibrated Harwell Boron-Vaseline-Plug Detector using the ZEBRA time-of-flight equipment. Calculations have also been made using the transport code, TURTLE, and the Monte Carlo program GEM. Discrepancies of 20% between calculated and observed efficiences are found in the energy region 70 to 130 keV, probably arising from inadequate nuclear and material composition data. A recommended efficiency from 100 eV to 1 MeV is given for the detector. Author (NSA)

N71-28982# Brussels Univ. (Belgium).
REGGE POLE THEORY AND DUALITY
R. Brout [1971] 149 p
(NP-18705) Avail: AEC Depository Libraries

These lectures on Regge pole theory and duality cover the kinematics, crossing, Regge poles, the experimental situation, finite-energy sum rules, the Veneziano model, and diffraction scattering. NSA

N71-28983 Institute of Nuclear Research, Warsaw (Poland).
FURTHER ANALYSIS OF NEUTRAL D MESON IN REACTION PION (+) PROTON YIELDS PROTON PION (+) PION (+) PION (-) PION (-) PION (0) AT 8 GeV/c
S. Otwinowski 1970 6 p refs
(INR-P-1207) Avail: AEC Depository Libraries

The existence of the intermediate delta pion state in the decay delta pion yields eta meson pion pion is discussed. It is shown that the reflection of the omega meson production cannot produce a spurious maximum in the (eta meson pion) mass distribution at the position of the delta. Author (NSA)

N71-28984# Stanford Linear Accelerator Center, Calif.
INELASTIC ELECTRON SCATTERING AT LARGE ANGLES
Guthrie Miller Jan. 1971 141 p refs
(Contract AT(04-3)-515)
(SLAC-129) Avail: NTIS

Electron-proton scattering cross sections were measured at electron scattering angles of 18, 26, and 34 deg for incident electron energies up to 18 GeV. These data extend in four momentum transfer squared (sq q) from 1 to 20 Ge(sq V) and in missing mass squared (sq W) up to 25 Ge(sq V). Using previously reported data at 6 and 10 deg, a separation of the two inelastic form factors was made in the deep inelastic region for sq q from 1.5 to 8 Ge(sq V). The transverse form factor is found to dominate in agreement with the expectations of various parton theories (for spin 1/2 partons). Determination of the inelastic form factor allowed an investigation of the question of scaling. Author (NSA)

N71-28985# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
MONOPOLE (I(PION) EQUALS 0(+)) EXCITATIONS IN EVEN-EVEN DEFORMED NUCLEI
N. I. Pyatov 1970 50 p refs In RUSSIAN; ENGLISH summary
(JINR-P4-5422) Avail: AEC Depository Libraries

The present status of the theoretical and experimental study of the monopole excitations in even nuclei in the ranges 150 less than or equal to A = 190 and A greater than or equal to 228 is reviewed. The systematics of known experimental data concerning the properties of 0(+) states is given. A number of phenomenological and microscopic descriptions of 0(+)-states in transitional and strongly deformed nuclei are considered. The properties of beta-vibrations, pairing vibrations, spin-quadrupole excitations, coherent pairing fluctuations, and of a number of other types of 0(+)-states are discussed. Attention is paid to the appearance in the spectra of the low-lying pairs of 0(+)-states, their properties being rather different. Author (NSA)

N71-28996 Oklahoma Univ., Norman.
AN EMULSION STUDY OF PION-NUCLEON INTERACTIONS AT 16.2 BeV
Jalal Samimi (Ph.D. Thesis) 1970 192 p
Avail: Univ. Microfilms Order No. 70-14430

Illford K-5 nuclear emulsion has been exposed to a 16.2 BeV negative pion beam. A total of 509 pion-nucleon interactions have been located by scanning along the track of 1.8 kilometer of the pion beam track. Experimental criteria for the collision of a pion with a single nucleon have been developed and all the interactions have been tested to satisfy these criteria. Kinematical quantities of most of the secondary particles from these interactions have been measured. A new formalism has been developed in multiple Coulomb scattering measurement techniques in determining momenta of the high energy pion tracks. The cross sections for different pion-nucleon processes are measured. The pion multiplicity distributions are obtained and compared to theoretical curves. The secondary pion transverse momentum distributions are fitted with different distribution functions. The dependence of the average transverse momentum on angle and multiplicity is obtained. Dissert. Abstr.

N71-28997 Michigan Univ., Ann Arbor.
LARGE ANGLE ANTIPROTON-PROTON ELASTIC SCATTERING
David George Falconer (Ph.D. Thesis) 1969 350 p
Avail: Univ. Microfilms Order No. 70-14511

An experimental and theoretical investigation of the large angle antiproton-proton cross section indicates that substantial local structure exists both as a function of beam momentum and four-momentum transfer. This structure may be attributed, respectively, to the formation of direct channel boson resonances, and the exchange of meson and nucleon states between the target and projectile. The differential cross section measurements were made at the six beam momenta (invariant masses) 1.63, (2298), 1.77 (2350), 1.83 (2368), 1.88 (2389), 1.95 (2412), and 2.20 GeV/c (2500 MeV), and at momentum-transfers squared greater than the absolute value of t = 0.3 (GeV/c) squared. The observed cross sections have been treated analytically by modifying several current theoretical models for application to antiproton-proton elastic scatterings. Dissert. Abstr.

N71-29003 Indiana Univ., Bloomington.
A METHOD FOR THE HIGH PRECISION MEASUREMENT OF RELATIVE INTENSITIES AND INTERNAL CONVERSION COEFFICIENTS IN THE DECAYS OF Ir192, Cr51, Bi207, AND Cs137
James Bernard Willet (Ph.D. Thesis) 1969 121 p
Avail: Univ. Microfilms Order No. 70-12412

The success of this method primarily depends on a series of interconnecting computer analysis routines which are designed to preserve the significance of the propagated uncertainties. High precision fitting is used to determine photopeak and conversion line intensities. A pair of relative efficiency curves are derived, one for gamma rays and one for electrons, with the property that the ratio of the electron efficiency to the gamma ray efficiency is known absolutely. The gamma ray efficiency curve is determined by the point-pair method, and the electron efficiency curve is determined from the gamma ray curve by a set of internal conversion standards. Relative electron and gamma ray intensities are determined from their respective curves and the uncertainties in the intensities are given in their complete matrix form. Internal conversion coefficients are determined directly from the absolute ratio of the two efficiency curves. These analysis procedures have been applied to data taken from the decys of Ir-192, Cr-51, Bi-207, and Cs-137. Dissert. Abstr.

N71-29004# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions.
EXPERIMENTS ON MEASUREMENT OF THE COMPOUND NUCLEUS LIFETIME IN THE W(Ne 22, f) REACTION
S. A. Karamyan, Yu. Ts. Oganesyan, and F. Normuratov 1970 17 p refs In RUSSIAN
(JINR-P7-5512) Avail: AEC Depository Libraries

The decreasing of the shadow depth in the angular distribution of the fission fragments is found when bombarding the W single crystal with the Ne-22 ions of 115 to 174 MeV energy. This fact is connected with the final lifetime of a compound nucleus from this reaction. The similar effect is not observed for the W(O-16,f) reaction at 137 MeV energy ions. The approximate value of the compound nucleus lifetime in the W(Ne-22,f) reaction at E sub i = 174 MeV is 2.5 times ten to the minus eighteenth power seconds. The main uncertainty of the mentioned value is connected with the fact that there is a set of fissionable compound nuclei with different A in bombarding the natural mixture of W isotopes. Author (NSA)

N71-29005# Institute of Nuclear Research, Warsaw (Poland).
PENETRATION OF A TWO DIMENSIONAL FISSION BARRIER
Z. Szymanski, A. Sobiczewski, and M. Zielinska-Pfabe 1970 7 p refs Presented at the Conf. on the Properties of Nuclei far from the Reg. of Beta Stability, Leysin, Switzerland, 31 Aug.–4 Sep. 1970
(INR-P-1230; CONF-700815-6) Avail: AEC Depository Libraries

The dynamical aspects of fission treated as a two dimensional process with quadrupole and hexadecapole degrees of freedom are discussed in the framework of microscopic theory. The inclusion of the hexadecapole degree of freedom decreases the spontaneous fission half lives by a few orders. Author (NSA)

N71-29006# Argonne National Lab., Ill.
ORIGIN OF FISSION-PRODUCT RELEASES IN EBR-2, 23

NOVEMBER 1967 – 6 MAY 1968
R. R. Smith, E. R. Ebersole, R. M. Fryer, and P. B. Henault. Dec. 1970 41 p refs
(Contract W-31-109-eng-38; EBR-2 Proj.)
(ANL-7604) Avail: NTIS

The second verified series of fission-product releases in EBR-2 began on November 23, 1967. Results of analyses for Xe-133 and Xe-135 in the cover gas system confirmed that the releases originated from fresh fuel material. Attempts to associate the releases with recently installed driver-fuel subassemblies were unsuccessful in view of a subsequent release on December 6, 1967. Eventually the releases were attributed to capsule BC02 in irradiation subassembly X028, capsule BC02 contained a prototypal fuel element of U-Pu-Zr ternary alloy. The results of postirradiation examinations on capsule BC02 revealed substantial fuel melting and rearrangement, particularly in the upper and lower regions. From these results and from observations of the various fission product releases from capcule BC02, a physical model of the defect was generated; this postulated model was consistent with all available experimental information. Author (NSA)

N71-29007# Tennessee Univ., Knoxville.
ABSORPTION AT REST AND LOW ENERGY ELASTIC SCATTERING OF K MINUS MESONS BY NEON
Jerry W. Moulder (Ph.D. Thesis) Aug. 1970 91 p refs
(TID-25667) Avail: NTIS

A bubble chamber filled with a 24 mole % mixture of neon and hydrogen, was exposed to a stopping negative kaon beam in order to study the interaction of negative kaons mesons with neon. On the basis of 1549 examples of negative kaon, neon interactions at rest, the general systematics are presented and comparisons are made with other negative kaon nucleus interactions. Various final state interactions are investigated and shown to be significant. Approximately 55% of the sigma hyperons produced in primary processes, undergo a final state interaction with a nucleon, producing neutral Lambda hyperons. The hyperfragment production rate is 10% and the nonmesic absorption rate 28% assuming no pion reabsorption. The hyperfragment production rate of neutral Lambda hyperons produced by Sigma hyperon conversion is estimated to be 14%, slightly higher than the overall hyperfragment production rate. The conversion rate of nonmesically produced signma hyperons is higher than the conversion rate for mesically produced sigma hyperons. Author (NSA)

N71-29009# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions.
PRODUCTION OF SPONTANEOUSLY FISSIONING ISOMERS OF URANIUM, PLUTONIUM, AND AMERICIUM IN THE NEUTRON REACTIONS
Yu. P. Gangrskii, T. Nagy, I. Vinnay, and I. Kovacs 1970 10 p refs In RUSSIAN
(JINR-P3-5528) Avail: NTIS

The cross sections of production of spontaneously fissioning isomers U-238, Pu-242, Am-243 in the reaction (n,n'f) and Am-242 in the reaction (n,2n) were measured. The upper limits of the production of fissioning isomers Th-231, U-234, U-237, and Pu-238 in the reaction (n,2n) were obtained. The time of flight method and neutrons from the reactions H-3 + d and Be-9 + d were used. Author (NSA)

N71-29010 California Univ., Los Angeles.
THE PROTON COMPTON EFFECT
James Victor Berk (Ph.D. Thesis) 1969 98 p
Avail: Univ. Microfilms Order No. 70-14261

The differential cross sections for the proton Compton effect have been measured at center-of-mass angles of 60, 75, and 90 deg for incident photon energies from 600 to 850 MeV. Both final state particles were detected. The incident photon energy was determined from the laboratory angle and time-of-flight of the recoil proton. The measured differential cross sections were consistent with cross sections measured in previous experiments and exhibit a smooth behavior as a function of scattering angle. Dissert. Abstr.

N71-29020# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).
HIGH-ENERGY POTENTIAL SCATTERING, PART 2
Hung Cheng and Tai Tsun Wu Dec. 1970 39 p refs
(Contract AT(30-1)-4101; Grant NSF GP-13775)
(DESY-70/67-Pt-2) Avail: NTIS

In view of the advances of knowledge, both experimental and theoretical, about hadronic scattering processes at high energies, the potential theory model studied before is found to exhibit a number of realistic features. Because partial differential equations can be dealt with in a much more straightforward manner than operator equations, this potential theory model is useful in understanding some features of high energy processes. The problem of exponentiation, and, the possible appearance of an exponential factor, is studied in detail. It is found that the simple exponentiation form, found recently in field theories within certain approximations, does not hold in general when the scattering particles have a size or internal degrees of freedom. This result in turn is applied to the field theoretical cases to further understand the nature of the approximations involved. Author (NSA)

N71-29021# National Inst. for Research in Nuclear Science, Chilton (England). General Physics Group.
THE PRESENT STATUS OF POLARIZED TARGETS AT THE RUTHERFORD LABORATORY
D. J. Nicholas, P. H. T. Banks, and D. A. Cragg Oct. 1970 24 p refs
(RHEL/R-201) Avail: AEC Depository Libraries; HMSO 5s; BIS $1.00

The polarized proton target in operation on Nimrod during 1970 is described. The target is based on dynamic polarization of protons in neodymium-doped lanthanum magnesium nitrate crystals. Details are given of several techniques new to polarized targets in current use including a new NMR system devised for the present target. Proton polarization, as measured by this NMR system, is compared with that measured by nuclear scattering techniques. Author (NSA)

N71-29022 National Lending Library for Science and Technology, Boston Spa (England).
DETERMINATION OF THE FORCE CONSTANTS OF POLYATOMIC MOLECULES BY THE MONTE CARLO METHOD [VIZNACHENNYA SILOVIKH STALIKH BAGATOATOMNIKH MOLEKUL ZA DOPOMOGOYU METODU MONTE-KARLO]
V. P. Morozov et al Jan. 1971 8 p refs Transl. into ENGLISH from Dopovidi Akad. Nauk Ukr. SSR, Ser. A (Kiev), v. 9, 1968 p 838 – 841
(NLL-RTS-6266) Avail: Natl. Lending Library, Boston Spa, Engl.: £0.60; 2 NLL photocopy coupons

Matrices of the quadratic potential and kinetic energy functions, whose elements are the force constants and the coefficients of inertia respectively, are constructed. Two methods of minimization based on the use of random numbers are examined, random searching with regression and multiple integrals. N.E.N.

N71-29028 Wisconsin Univ., Madison.
HIGH RESOLUTION STUDY OF THE He II 6560A AND 10124A TRANSITIONS
Ernest George Kessler, Jr. (Ph.D. Thesis) 1969 153 p
Avail: Univ. Microfilms Order No. 70-3579

A high resolution study of the He II 6560A (n = 6 to n = 4) and 10124A (n = 5 to n = 4) line complexes as observed in a liquid nitrogen cooled hollow cathode has been made with a pressure

scanned double Fabry–Perot spectrometer. All signals were photoelectrically detected and the data were digitally recorded and analyzed with a computer. The relative separations, relative intensities, line widths, and isotope shift of the more intense isolated components have been measured. The theoretical component separations have been confirmed to within 0.002/ cm for the best measured components. Lamb shift measurements for the 4S, 5S, and 6S levels for He II have been determined from the measured separations of the components. Dissert. Abstr.

N71-29037# Institute of Nuclear Research, Warsaw (Poland).
RHO-PHOTON COUPLING CONSTANT AND THE RHO-NUCLEON SCATTERING AMPLITUDE
M. Staszel and G. Wilk 1969 11 p refs
(INR-P-1166) Avail: AEC Depository Libraries

Some recent data on the rho(0) photoproduction on nuclei were analyzed in terms of Glauber model of multiple scattering in order to calculate the value of the rho-photon coupling constant. The numerical results depend on the assumed value alpha rho nucleon of the ratio of the real to the imaginary part of the elementary rho-nucleon scattering amplitude. For absolute value of alpha rho nucleon = 0.3, which is a reasonable assumption, one obtains results consistent with the value of gamma square rho/Delta pi = 1.0, obtained at SLAC from the different analysis of the same data. Author (NSA)

N71-29038*# Wisconsin Univ., Madison. Theoretical Chemistry Inst.
MOLECULAR COLLISIONS. 15: CLASSICAL LIMIT OF THE GENERALIZED PHASE SHIFT TREATMENT OF ROTATIONAL EXCITATION: ATOM-RIGID ROTOR
M. D. Pattengill, C. F. Curtiss, and R. B. Bernstein 16 Apr. 1971 39 p refs
(Grants NGL-50-002-001; NSF GP-12832; NSF GB-16665)
(NASA-CR-119029; WIS-TCI-436) Avail: NTIS CSCL 20H

The generalized phase shift (GPS) approach to the problem of rotationally inelastic molecular collisions is extended from the level of the first order approximation to the essentially infinite order level, but specialized to the full classical limit. The limitations and assumptions are that (1) the de Boer reduced wavelength parameter be small, (2) the relative translational motion takes place under the influence of the orientation-averaged part of the anisotropic interaction potential, and (3) the rotational energy, E sub rot may be well approximated by its classical expression. The procedure is applied numerically to a model problem involving an anisotropic L-J. (12,6) potential, taking advantage of the previously computed generalized action integrals. The program yields directly an arbitrarily chosen specified number of moments of the inelasticity probability density function P(Delta sub rot) at various impact parameters b. Inversion of the set of moments leads to P(Delta E sub rot). For the examples chosen, the lowest eight moments sufficed to obtain practical accuracy of convergence on the inversion. Author

N71-29047# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Physics.
NUCLEAR PHYSICS LABORATORY Progress Report, 1 Nov. 1969 - 31 Oct. 1970
1970 57 p refs
(Contract AT(11-1)-1573)
(COO-1573-71) Avail: NTIS

Experimental and theoretical research on elastic and inelastic neutron scattering cross sections by angular distributions of helium-4 and lithium-7, is reported. Reactions are given for neon-20, oxygen, and deuterons. Data are also given on the search for a bound trineutron, the production cross sections and the elastic scattering of trineutrons. Polarization and instrumentation data are included. E.H.W.

N71-29056# Commissariat a l'Energie Atomique, Bruyers-le-Chatel (France). Centre d'Etudes.
MONOCHROMATIC X-RAYS [RAYONS X MONOCROMATIQUES]
Pierre Ballereau Jan. 1971 101 p refs In FRENCH
(CEA-Bib-194) Avail: AEC Depository Libraries

Monochromatic X-rays are finding an increased use in crystallographic studies and radiographic work. In health physics, they are very useful for dosimeter calibration and are an essential tool for the calibration of film badges in which the blackening is strongly dependent on the incident photon energies between 10 and 300 keV. None of the monochromatization techniques proposed is perfect. Bibliographic research on the more pertinent articles and reports published on the matter was necessary. Author (NSA)

N71-29057# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Neutronenphysik und Reaktortechnik.
EVALUATION OF FAST CRITICAL EXPERIMENTS USING RECENT METHODS AND DATA
E. Kiefhaber and J. J. Schmidt Sep. 1970 233 p refs Sponsored by US-Euratom
(EURFNR-858; KFK-969; EANDC(E)-118(U)) Avail: AEC Depository Libraries

The influence of changes in nuclear data on the calculated values for the criticality and other important parameters of critical assemblies is analyzed. The analysis is done for a variety of assemblies which differ in geometry, material composition, and energy distribution of the normal and adjoint flux. The primary objective is: to detect deficiencies in nuclear data and calculational methods; to get first preliminary improvements; and to get indications in which respect and in which way further long-range improvements should be carried on. The long-range aim of this kind of investigations is to provide or establish satisfactory nuclear data and calculational methods which can reliably be applied to the calculation of fast critical assemblies and of large fast power reactors. Author (NSA)

N71-29059# Japan Atomic Energy Research Inst., Tokyo.
TABLE OF HALF-LIFE, GAMMA-RAY ENERGY, AND INTENSITY OF RADIOISOTOPES
Katsuaki Kumagai Nov. 1970 31 p refs In JAPANESE; ENGLISH summary
(JAERI-Memo-4189) Avail: AEC Depository Libraries

The gamma-ray energies and the intensities of a number of radioactive nuclei are presented graphically. The radioactive nuclei, which have the half-life of 3.5 sec to 1.12 × 10 to the 11th power years, are arranged by the order of half-life, and their gamma-ray energies are plotted together with their intensities. Photopeaks in gamma-ray spectra can be easily assigned from this table. Author (NSA)

N71-29060# California Univ., Berkeley. Lawrence Radiation Lab.
LRL RACETRACK MICROTRON
Lawrence Ruby and Joseph B. Rechen 15 Dec. 1970 15 p refs
(Contract W-7405-eng-48)
(UCRL-20230) Avail: NTIS

A racetrack microtron is described, which is patterned after a similar machine at the University of Western Ontario. The LRL microtron produces 10 mA peak currents at 60 pulses per second. Only modest shielding and air cooling are required. An external beam is either used directly or converted to bremsstrahlung. Author (NSA)

N71-29061# Brussels Univ. (Belgium). Dept. of Physics.
INVESTIGATIONS IN NON EQUILIBRIUM STATISTICAL PHYSICS Final Scientific Report, Feb. 1969 - Jan. 1971
I. Prigogine Feb. 1971 27 p refs
(Grant EOOAR-0058-69)
(AD-722065; AFOSR-71-0920TR) Avail: NTIS CSCL 7/4

A summary of the main results obtained in Non Equilibrium

Statistical Mechanics and Non Equilibrium Thermodynamics during the period of the grant is given. The most striking results in Non Equilibrium Statistical Mechanics is the derivation of subdynamics. In Non Equilibrium Thermodynamics it is the concept of dissipative structures. Author (GRA)

N71-29070# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Serpukhov (USSR). Institut Fiziki Vysokikh Energii.
SOME RESULTS ON THE COMPLEX ADJUSTMENT AND START-UP OF THE IHEP PROTON SYNCHROTRON
Yu. M. Ado et al Nov. 1970 19 p refs Transl. into ENGLISH from Russian report No. IFVE-SKU-69-88 Revised
(CERN-Trans-70-12-Rev) Avail: AEC Depository Libraries

A brief history of the construction and commissioning of the Serpukhov 70-GeV proton synchrotron is given, and the main parameters of the accelerator are listed. A short description of the adjustments of the ring magnet system, injection system, vacuum system, RF system, and beam observation system is given. Also, the method and results of the initial start-up of the accelerator are outlined. NSA

N71-29071# Institute of Nuclear Techniques, Krakow (Poland).
TABLES OF MAGNETIC STRUCTURES DETERMINED BY NEUTRON DIFFRACTION. PART 1: CUBIC SYSTEM
A. Oles, A. Bombik, M. Kucab, and W. Sikora Aug. 1970 75 p refs
(NP-18718-Pt-1; Int-1-Pt-1; Rept-1/PS-Pt-1) Avail: AEC Depository Libraries

The tables contain: the chemical symbols of a substance; space group; cation distribution temperatures of crystal distortions; information on crystal ordering for alloys; temperatures of magnetic transitions; brief descriptions of magnetic structure including figures; magnetic moments of atoms, and effective magnetic moments; and additional references on magnetic investigations. For some magnetic structures, magnetic space groups were indicated. These tables contain the metals and compounds crystallizing in the cubic system. Author (NSA)

N71-29072# Commissariat a l'Energie Atomique, Grenoble. (France). Centre d'Etudes Nucleaires
STUDY AND DEVELOPMENT OF CADMIUM TELLURIDE DETECTORS FOR GAMMA-RAY SPECTOMETRY [ETUDE ET REALISATION DE DETECTEURS NUCLEAIRES AU TELLURURE DE CADMIUM EN VUE D'UNE UTILISATION EN SPECTROMETRIE DE RAYONNEMENT GAMMA]
Gerard Knispel (Ph.D. Thesis — Univ. of Grenoble, France) Jan. 1971 85 p refs In FRENCH
(CEA-R-4052) Avail: AEC Depository Libraries

The possibility of using CdTe as a detector in gamma ray spectrometry was investigated. Detectors constructed of this material have certain advantages over the conventionally used Ge(Li). Interactims between radiations and CeTe were studied. The ranges of alpha and beta particles and the capture cross sections for gamma ray photons as a function of their energies were deduced from data tabulated for tin which has almost the same density and atomic mass. Problems related to the creation and collection of charges in CdTe structures are examinad and resolution problems in nuclear spectrometry considered in terms of the different parameter characteristics of the detector. The metallurgy of CdTe is discussed and the preparation of several different types of structure described: evaporation of a CdTe layer, diffusion of Au or Cu, and semiconductor metal contact. The current voltage characteristics and capacity measurements made enabled certain parameters to be ascertained and the suitability of using CdTe detectors in nuclear spectroscopy to be examined. Author (NSA)

N71-29073# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
TWO DIMENSIONAL ANALYZER FOR THE HALF LIFE MEASUREMENTS OF THE NUCLEUS OF EXCITED STATES BY THE GAMMA-GAMMA DELAYED COINCIDENCE METHOD ON THE BASIS OF COMPUTER MINSK-2
V. A. Morosov, V. I. Razov, V. I. Fominykh, and V. M. Tsupko-Sitnikov 1970 18 p refs In RUSSIAN
(JINR-P13-5485) Avail: AEC Depository Libraries

A coincidence circuit for two-dimensional measurements of the half-lives of nuclear excited states in the nano- and microsecond range is described. Author (NSA)

N71-29074# Atomic Weapons Research Establishment, Aldermaston (England).
EVALUATION OF anti nu FOR Pu 239
D. S. Mather and P. F. Bampton Dec. 1970 18 p refs
(AWRE-O-86/70; EANDC(UK)-125-AL) Avail: AEC Depository Libraries

Data available before July 1970 on direct measurements of anti nu for the neutron-induced fission of Pu-239 are considered, and an evaluation consisting of a set of four straight lines specifying the variation of anti nu with neutron energy is produced for entry in a new data file DFN-269. Author (NSA)

N71-29086# Central Research Inst. for Physics, Budapest (Hungary).
NEUTRON DOSIMETRY BY SEMICONDUCTOR DETECTORS AND HYDROGENOUS RADIATOR ASSEMBLY
S. Deme 1 Nov. 1970 7 p refs
(KFKI-70-29-HP) Avail: AEC Depository Libraries

Two methods of applying semiconductor diodes to neutron dosimetry have been studied. In the first a homogeneous polyethylene radiator and a fully depleted semiconductor detector of dE/dx type were used and the dose in rad units was calculated from the proton spectrum obtained in the semiconductor detector. In the second the protons emerging from a multilayer, sandwiched polyethylene-aluminum radiator were counted by a semiconductor detector. The structure of the radiator was such that the dose in rad was characterized by the number of protons emerging with an energy above a given threshold. The energy dependence and accuracy of both methods were determined by calculation and direct measurement. It was found that both methods are suitable for measuring to + or − 10% accuracy collimated neutron beams in the energy interval from 0.5 to 10 MeV with neutron intensities higher than a few rad/hr. Author (NSA)

N71-29103# European Organization for Nuclear Research, Geneva (Switzerland).
VACUUM SYSTEM FOR THE 70-GeV PROTON SYNCHROTON [LE SYSTEME A VIDE DU SYNCHROTRON A PROTONS DE 70 GeV]
A. D. Artemov et al Nov. 1970 30 p refs Transl. into FRENCH of Gos. Kom. po Ispol'z. At. Energii SSSR, Inst. Fiz. Vysokikh Energii, Serpukhov, USSR, report IFVE-SKU-69-100 In FRENCH
(CERN-Trans-70-9; IFVE-SKU-69-100) Avail: AEC Depository Libraries

Data are given for the construction of the vacuum chamber as well as the assembling and adjustment of the vacuum system for the 70-GeV proton synchrotron. A vacuum of 000002 torr was obtained using titanium electric discharge pumps of the type NEM-300. Author (NSA)

N71-29104# Aktiebolaget Atomenergi, Studsvik (Sweden).
SPECTRAL PARAMETERS IN WATER-MODERATED LATTICES: A SURVEY OF EXPERIMENTAL DATA WITH THE AID OF TWO-GROUP FORMULAE
E. K. Sokolowski Oct. 1970 23 p refs
(AE-405) Avail: AEC Depository Libraries

A set of analytical two-group formulas for the Westcott spectral indices is used as basis for comparison of a large number of experimental data on heavy and light water moderated lattices. The consistency of the data is generally found to be within the

experimental errors. A comparison with multigroup transport calculations indicates that the latter overestimate the epithermal spectrum component, which could in part explain the empirical need for reducing the U-238 resonance cross section in such calculations. Author (NSA)

N71-29105# Illinois Univ., Urbana. Noyes Chemical Lab.
THE CARBON-13 INTENSITY PROBLEM: ELIMINATION OF THE OVERHAUSER EFFECT WITH AN ADDED PARAMAGNETIC SPECIES
David F. S. Natusch 22 Jan. 1971 10 p refs
(Contract N00014-66-C-0010-A04)
(AD-721732; TR-22) Avail: NTIS CSCL 7/4

The spectral simplification and increase in effective S/n produced by proton decoupling in 13C NMR spectroscopy is frequently accompained by signal enhancement due to the operation of a 13C-1H Overhauser effect. The magnitude of the Overhauser enhancement ordinarily differs for different 13C nuclei so the simple relationship between resonance intensity and the number of 13C nuclei no longer holds. A theoretical analysis showing that the Overhauser effect should indeed be reduced by paramagnetic species is presented and the criteria which govern the extent of the reduction are included. The existence of such reduction has been confirmed experimentally. Author (GRA)

N71-29106# Japan Atomic Energy Research Inst., Tokyo.
PULSED NEUTRON RESEARCH IN JAPAN FROM 1965 TO 1970
Yoshihiko Kaneko and Kenji Sumita (Osaka Univ.) Aug. 1970 27 p refs Presented at the IAEA Panel on Pulsed Neutron Research, Vienna, 17–21 Aug. 1970
(JAERI-4109) Avail: AEC Depository Libraries

The activities in the field of pulsed neutron research in Japan since 1965 are reviewed. These activities include: (1) neutron slowing-down and thermalization in reactor materials; (2) application to multiplying media; (3) neutron wave and pulse propagation; (4) time of flight experiment by use of electron linear accelerator; and (5) pulsed reactors. Author (NSA)

N71-29107# Indiana Univ., Bloomington. Dept. of Physics.
A NEW TOOL FOR SCATTERING STUDIES
Pierre C. Sabatier 1971 64 p refs Sponsored in part by AROD, Durham, N.C.
(AD-721908; AROD-5992-42) Avail: NTIS CSCL 20/8

In potential scattering, from the transformation kernel, a function K(rho) is constructed whose Bessel transforms are the Jost functions. K(rho) contains the whole information on the potential V(rho). There is a one to one correspondence between the two functions, and they are related, in both senses of this correspondence, through integral equations. Since the relation between K(rho) and the phase shift is very direct, it is a useful tool for all analyses of the relations between the information contained in the dynamics of the problems (viz the potential) and the measurable information (viz the phase shifts). Also, the derivation of K(rho) makes clear that a similar study can be done in all cases to which the Gelfand Levitan scheme applies, therefore in most scattering problems in physics. Author (GRA)

N71-29108# Instituto de Energia Atomica, Sao Paulo (Brazil).
PHOTOFISSION CROSS SECTIONS OF URANIUM AND THORIUM NEAR THRESHOLD
O. Y. Mafra, S. Kuniyoshi, and F. G. Bianchini May 1970 17 p refs
(IEA-211) Avail: AEC Depository Libraries

Using monochromatic gamma rays from (n,gamma) reactions, the photofission cross section behavior for natural uranium and thorium was determined in the 5 to 10 MeV energy interval. Bumps around the energies of 6 and 6.6 MeV for uranium and around 6.7 and 7.6 MeV for thorium were found. The existence of this structure in the photofission cross section near the threshold is in accordance with Bohr's theory about the excitation of rotational states. Author (NSA)

N71-29109# California Inst. of Tech., Pasadena. Kellogg Radiation Lab.
A PROGRAM OF MEASUREMENT OF OSCILLATOR STRENGTHS OF LINES AND LIFETIMES OF ENERGY LEVELS IN ATOMIC AND IONIC SPECTRA Final Report, 1 Feb. 1952–28 Feb. 1971
Ward Whaling Mar. 1971 6 p refs
(Contract N00014-67-A-0094-0015)
(AD-721686) Avail: NTIS CSCL 7/4

A brief summary is given of the results of a program of research on the measurement of atomic oscillator strengths. GRA

N71-29110# Ballistic Research Labs., Aberdeen Proving Ground, Md.
INFLUENCE OF SOLUTION STRUCTURE ON HYDRATED ELECTRON REACTIONS
Nathan Klein Feb. 1971 45 p refs
(AD-721299; BRL-1531) Avail: NTIS CSCL 7/5

The ultra-fast, apparent second-order decay of the hydrated electron, e(-)(aq), following nanosecond duration radiation pulses in air-free alkaline solution is discussed in detail. The proposed structure and properties of H2O(+)(aq) are described and reactions of this non-classical ion are discussed. The importance of solution structure in charge migration and the effect of various salts on solution structure is reviewed. Author (GRA)

N71-29111# National Bureau of Standards, Washington, D.C.
RADIATION TRANSPORT STUDIES CARRIED OUT AT THE NATIONAL BUREAU OF STANDARDS Progress Report, 1 Jul. 1970–15 Feb. 1971
M. J. Berger, C. M. Eisenhauer, S. M. Seltzer, G. L. Simmons, and L. V. Spencer 1 Mar. 1971 61 p refs
(NAonr-4-71)
(AD-721388; NBS-10550) Avail: NTIS CSCL 18/11

This is a progress report describing research on the following topics: On the accuracy of transport calculations using moment methods; Improved moment-method calculations of gamma-ray transport: application to point isotropic sources in water; Poly-series approximation of functions; Neutron dose in air from a point-isotropic fission source; Improvement in computer program to generate neutron flux moments; Response of NaI detectors to high energy gamma rays; Absorbed dose near an interface between two media. Author (GRA)

N71-29112 Michigan Univ., Ann Arbor.
DIFFERENTIAL CROSS SECTION MEASUREMENTS OF THE REACTION PION(+) PLUS PROTON YIELDS KAON (+) PLUS Y1*(1385) AT 4 AND 5.05 GeV/c
Shuh-Pan Ying (Ph.D. Thesis) 1969 54 p
Avail: Univ. Microfilms Order No. 70-14690

Approximately 1900 events were obtained in a counter and spark chamber experiment for the production of the baryon resonance positive Y1*(1385) in positive pion and proton collisions. Forward peaks of the differential cross section curves were found with slopes of 2.3 + or − .3 and 2.6 + or − .4 (GeV/c)sup minus 2 for 4 and 5.05 GeV/c respectively. These data together with that on other decuplet production reactions allow us to test SU(3) symmetry. The results indicate a large amount of SU(3) breaking which can be corrected for by assuming a mass difference between the strange and non-strange exchange particles. Dissert. Abstr.

N71-29113# Office of Naval Research, London (England).
INTERNATIONAL CONFERENCE ON HYPERFINE INTERACTIONS DETECTED BY NUCLEAR RADIATION

I. Estermann 31 Dec. 1970 15 p refs Conf. held at Rehovoth and Jerusalem, Israel, 6–11 Sep. 1970
(AD-720684; ONRL-C-32-70) Avail: NTIS CSCL 7/4

The conference on hyperfine interactions dealt with new measurements of nuclear magnetic dipole and electric quadrupole moments of isotopes and excited states of short lifetimes down to the order of picoseconds, and with the use of these atoms when implanted in solids for the measurement of internal fields. Measurement techniques reported included angular correlation methods, nuclear orientation at low temperatures, nuclear stroboscopy, nuclear magnetic resonance, Mossbauer effect, and optical pumping. New values for 30 nuclear g-factors and 3 quadrupole constants were reported. Author (GRA)

N71-29119*# Translation Consultants, Ltd., Arlington, Va.
TEMPERATURE DEPENDENCE OF THE TOTAL CROSS SECTION STRUCTURE OF URANIUM-238 IN THE UNRESOLVED RESONANCE REGION [TEMPERATURNAYA ZAVISIMOST' STRUKTURY POLNOGO SCHENIYA URANA-238 V OBLASTI NERAZRESHENNYKH REZONANSOV]
A. A. Van'kov et al Washington NASA Jun. 1971 15 p refs Transl. into ENGLISH from Proc. of the 2nd Intern. Conf. on Nucl. Data for Reactors (Helsinki), 15–19 Jun. 1970, IAEA-CN-26/85 (Vienna) p 559–569
(Contract NASw-2038)
(NASA-TT-F-13693) Avail: NTIS CSCL 20H

The transmission of neutrons is measured in the range 1 to 100 keV through uranium-238 samples varying in thickness between 1 mm and 128 mm at -196 C, 20 C and 770 C using the time of flight neutron spectrometer. The IBR pulsed fast reactor was used as neutron source. By using programs for calculating transmission and parameter otpimization to process the experimental data, they obtained a set of average resonance parameters for uranium-238 describing the structure of the cross section and its temperature dependence. Author

N71-29120# Junta de Energia Nuclear, Secavem (Portugal). Laboratorio de Fisica e Engenharia Nucleares.
CALCULATION OF VARIATION WITH TIME OF THE NEUTRON DENSITY IN A REACTOR AFTER AN ABRUPT CHANGE IN REACTIVITY
Jaime M. Costa Oliveira 1969 14 p In PORTUGUESE
(LFEN-NI-48-a) Avail: AEC Depository Libraries

The LFEN-FR6 program for calculating the spatial neutron flux distribution variation with time following a reactivity perturbation in a point model reactor is described. The program is written in FORTRAN 4 for the IBM 360/50. The mathematical formulation of the problem, the program input, and a sample output are presented. NSA

N71-29121# Atomic Energy of Canada, Ltd., Chalk River (Ontario). Physics Div.
[NUCLEAR, NEUTRON, AND THEORETICAL PHYSICS RESEARCH AND COMPUTATION] Progress Report, 1 Jan.–31 Mar. 1970
[1970] 114 p refs
(AECL-3667; PR-P-85) Avail: AEC Depository Libraries; Atomic Energy of Can., Ltd., Chalk River: $2.00

Work performed by the nuclear physics branch, the general physics branch, the neutron physics branch, the theoretical physics branch, and the mathematics and computation branch at the physics division of AECL in the period January 1 to March 31, 1970 is reported. NSA

N71-29122# Deutsches Elektronon-Synchrotron, Hamburg (West Germany).
HIGH-ENERGY SCATTERING OF A FERMION WITH ANOMALOUS MAGNETIC MOMENT: NONEXPONENTIATION
Hung Cheng (MIT, Cambridge) and Tai Tsun Wu Jan. 1971 9 p refs
(Contract AT(30-1)-4101; NSF Grant GP-13775)
(DESY-71/1) Avail: NTIS

Although it is well-known that the scattering amplitude for a Dirac particle in a potential takes a simple exponentiation form at high energies, it is shown that this is no longer the case, if the Dirac particle has an anomalous magnetic moment like the proton. This serves as an example of the conclusion that simple exponentiation holds only if a particle can be treated as a point with no structure or internal degrees of freedom. This means that simple exponentiation is unlikely to occur for high energy amplitudes of hadron–hadron scattering. Author (NSA)

N71-29124 Brown Univ., Providence, R.I.
LOW AND HIGH FIELD LEVEL CROSSING EXPERIMENTS IN 2P STATE OF ATOMIC HYDROGEN: A NEW MEASUREMENT OF THE SOMMERFELD FINE STRUCTURE CONSTANT
John Russell Brandenberger (Ph.D. Thesis) 1969 106 p
Avail: Univ. Microfilms Order No. 70-8694

Two level-crossing experiments involving the 2P states of atomic hydrogen are discussed. One experiment concerns the fine structure crossings near 3484 gauss; from precision measurements of the location of these crossings, the 2P1/2-2P3/2 fine structure interval and Sommerfeld fine structure constant are determined. This experiment nearly complete and the results are: Delta Epsilon(2P1/2-2P3/2 = 10969.13(.12) MHz alpha(-1) = 137.0354(7). The other experiment concerns crossings in the 2P3/2 state near zero field. This experiment is incomplete, but preliminary results indicate that precision lifetime measurements will be possible. Experimental details and possible sources of systematic errors in both experiments are discussed. Dissert. Abstr.

N71-29140 Yeshiva Univ., New York.
A CIRCULAR MODEL FOR AN INTERACTING FERMI GAS
Eleonora Meira Witteles (Ph.D. Thesis) 1969 228 p
Avail: Univ. Microfilms Order No. 70-11612

A circular, one dimensional model for an interacting Fermi gas is developed. An interparticle potential having the properties that its Fourier transform has a functional form (1–) (sup k)/k sq. and whose spatial form is such that it can be solved exactly in the thermodynamic limit using the Green's function technique. The results obtained from such an exact solution are compared with the conclusions reached by studying the problem using a Modified Random Phase Approximation (MRPA). The study of the system in the MRPA shows that a first order phase transition is possible. The thermodynamic properties of the system and the question of the possibility of a first order phase transition is also studied in the exact solution of the model system. Dissert. Abstr.

N71-29141# Institute of Nuclear Physics, Krakow (Poland).
REAL PART OF THE ALPHA-NUCLEUS POTENTIAL OBTAINED BY DOUBLE FOLDING PROCEDURE
A. Budzanowski, A. Dudek, K. Grotowski, and A. Strzalowski 1970 10 p refs
(INP-720) Avail: AEC Depository Libraries

A microscopic analysis of the elastic scattering of 27.5 MeV alpha particles by Co-59 nuclei is presented. The real part of the alpha-nucleus optical-model potential was obtained from the elementary nucleon-nucleon interaction using the double-folding procedure. The matter-density distributions for the target nucleus and alpha particles were taken from recent experimental data. Calculations were made for several simple forms of the effective nucleon-nucleon interaction. Author (NSA)

N71-29144# Brookhaven National Lab., Upton, N.Y. Lab. of Theoretical Physics.
INVESTIGATION OF THE HEISENBERG MODEL OF THE IMPURE FERROMAGNETS, PART 2
E. Provetski Nov. 1970 15 p refs Transl. into ENGLISH from Russian report Sponsored by AEC
(BNL-tr-390) Avail: NTIS

Different physical quantities for the Heisenberg model of impure ferromagnets were investigated. The spatial transverse correlation functions for the spins were calculated. The magnetization was calculated as a function of an arbitrary lattice point and the elastic and transverse inelastic parts of the scattering cross section of slow neutrons were also calculated. Author

N71-29145 Michigan Univ., Ann Arbor.
TRANSITIONS OF THE 4T2 STATE IN PINK RUBY AND DEVELOPMENT OF MEASURING TECHNIQUES FOR SHORT LIFETIMES
Patrick Nixon Everett (Ph.D. Thesis) 1969 168 p
Avail: Univ. Microfilms Order No. 70-14510

It was demonstrated by direct measurements that the 4T2 state lifetime is less than 2 ns at temperatures between 2 K and 300 K. No fluorescent emission from the 4T2 state was observed although extremely high excitation powers and sensitive detection equipment were used. It was demonstrated that the nonradiative transitions 4T2 yields 2E occur with a frequency which is greater by a factor of at least 300,000 than that of the fluorescent 4T2 yields 4A2 transitions. If the 4T2 yields 4A2 transitions are considered to be purely electronic, it is shown that the lifetime of the 4T2 state must be less than 45 ps. In the more likely event that the transitions are vibrationally assisted, it is shown that the lifetime must be less than 3.5 ps. A model of the transitions involving a Franck-Condon diagram, activation energies, and frequency factors is discussed. It is shown that some of the previously proposed parameters are incompatible with the new experimental results. Dissert. Abstr.

N71-29147 Illinois Inst. of Tech., Chicago.
INELASTICITY AND N/D CALCULATIONS
George Raymond Bart (Ph.D. Thesis) 1970 135 p
Avail: Univ. Microfilms Order No. 70-13560

The first study relates to a Reggeized N/D approach in which the left-cut term and elasticity are determined at high energies to be consistent with partial wave projections of Regge type amplitudes. The N/D integral equation is Fredholm in this case. For the second area of study, amplitudes are considered which have negligible left-cut contributions to the N/D potential function. The presence of a narrow dip in the elasticity is shown to yield an N/D solution with a circular Argand plot which corresponds to the Breit-Wigner case of a highly inelastic resonance. The pion-N P11 state is the last area of study. An evaluation of the left-cut term using experimental phase shift in formation is shown to yield values in good agreement with those obtained by using crossing relations. Dissert. Abstr.

N71-29163# Institute of Nuclear Physics, Krakow (Poland).
PROCEEDINGS OF THE X CRACOW SCHOOL OF THEORETICAL PHYSICS. VOLUME 1: SCATTERING OF COMPOSITE OBJECTS
Jun. 1970 176 p refs Submitted for publication
(INP-712-Vol-1) Avail: AEC Depository Libraries

The lectures presented at the conference are reported. Subjects discussed include: high energy proton scattering by nuclei, computations of Delbrueck scattering, and photoproduction on heavy nuclei. F.O.S.

N71-29164# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
SEARCH FOR THE DECAY MUON(+) YIELDS POSITRON PLUS POSITRON PLUS ELECTRON
S. M. Korenchenko, B. F. Kostin, G. V. Mitselmakher, K. G. Nekrasov, and V. S. Smirnov 1970 6 p refs In RUSSIAN
(JINR-P1-5542) Avail: AEC Depository Libraries

The positive muon decay was searched for with the help of a cylindrical spark chamber placed in the 4500 Oe magnetic field. Scintillator counter pulses were displayed on the five ray oscilloscope screen. About 300 thousand pairs of pictures were taken. After previous scanning, 226 events were selected, measured, and calculated by the computer. With the help of the chi squared criteria the consistency of the taken events to the geometrical requirements and to the kinematics of the geometrical requirements and to the kinematics of the decay was established. Such events can be imitated by one positron or electron passing through the whole chamber. As a result not a single event could be regarded as the positive muon decay. The detection efficiency of the decay was calculated by the Monte Carlo method taking into account chamber geometry and triggering conditions. The decay matrix element was taken constant. After introducing necessary corrections the detection efficiency of the decay was obtained to the .034. This permits the upper limit of the branching ratio to be established. Author (NSA)

N71-29166# European Organization for Nuclear Research, Geneva (Switzerland).
COMPILATION OF CROSS SECTIONS. 5: KAON(-) INDUCED REACTIONS
E. Flaminio, J. D. Hansen, D. R. O. Morrison, and N. Tovey 22 Oct. 1970 212 p refs
(CERN/HERA-70-6) Avail: AEC Depository Libraries

A compilation of cross sections of reactions produced by negative kaons on targets of protons, neutrons and deuterons is presented. Graphs of the variation of cross section with incident laboratory momentum are plotted. Values for the rate of decrease of cross section with incident momentum are given. Author (NSA)

N71-29167# Japan Atomic Energy Research Inst., Tokyo.
GROUP STRUCTURE AND ACCURACY OF GROUP CONSTANTS IN THE VICINITY OF 2.85-keV RESONANCE SCATTERING OF SODIUM
Tatsuzo Tone and Akira Hasegawa Aug. 1970 38 p refs In JAPANESE; ENGLISH summary
(JAERI-4110) Avail: AEC Depository Libraries

Interrelations between group structure and the accuracy of group constants in the vicinity of the 2.85 keV resonance scattering of sodium were examined, mainly based on a group constant set. Large differences of elastic removal cross section were observed between 70 and 25 group structures. The differences bring larger variations in k sub eff than in sodium void effect, and the results obtained from fine spectrum calculations show that sigma sub er from 70 group structure is better than from 25 group structure. Author (NSA)

N71-29171# Montpellier Univ. (France). Department de Physique Mathematique.
HADRONIC PRODUCTION IN POSITRON ELECTRON COLLISIONS
J. Layssac and F. M. Renard Mar. 1971 31 p refs
(PM/71/2) Avail: NTIS

The hadronic production in positron electron collisions is studied in the framework of the vector dominance model. The cross sections are supposed to be dominated by the quasi-two-body final states coupled to the rho, omega, and phi mesons. The results are given for positron electron yields 4 pion, 5 pion, 6 pion, eta meson + 2 pion, eta meson + 3 pion, eta meson + 4 pion, kaon antikaon + 2 pion, kaon antikaon + 3 pion, and kaon antikaon + 4 pion. In the range E sub tot < 3 Gev, it appears that the cross sections are of the order of 10 to the minus 32nd power sq cm in agreement with the measurements done with Adone. Author

N71-29172# Institute of Nuclear Physics, Krakow (Poland).
ACCURACY OF THE NEUTRON METHOD OF MOISTURE MEASUREMENT
E. Sciesinska Jun. 1970 43 p refs Submitted for publication
(INP-709) Avail: AEC Depository Libraries

A discussion is given of the influence of density and chemical composition of the medium, as well as of the measurement geometry, on the accuracy of the neutron method of moisture measurement. Experimental and theoretical calibration curves obtained for foundry mass in finite 4 pi-geometry were compared for this purpose. The influence of density was investigated for all variants of the 4 pi-geometry employed whereas the influence of absorbents of thermal neutrons was studied only for the simplest geometry. The incompatibility of the obtained results with the Fermi age theory is interpreted. Accuracies of the epithermal and thermal variant of the neutron method are compared. Author (NSA)

N71-29173# Institute of Nuclear Research, Warsaw (Poland).
GAMMA VIBRATION OF NUCLEI AT EQUILIBRIUM AND SADDLE POINT
M. Zielinska-Pfabe 1970 35 p refs
(INR-P-1201) Avail: AEC Depository Libraries

The gamma-vibrational parameters B sub gamma, C sub gamma, and the energy E sub gamma of the gamma-vibrational state of deformed nuclei were calculated as functions of the beta deformation in the whole region between equilibrium and the saddle point. Both the microscopic and macroscopic descriptions were used. The following result was obtained: when beta increases from its equilibrium value to the saddle point, the nucleus begins to be more stiff with respect to the gamma vibration. The quadrupole coupling constant should increase with the deformation of the nucleus. Author (NSA)

N71-29176 Princeton Univ., N.J.
QUANTUM CORRECTIONS TO CLASSICAL TIME CORRELATION FUNCTIONS
James T. Hynes (Ph.D. Thesis) 1969 177 p
Avail: Univ. Microfilms Order No. 70-14217

The problem of obtaining explicit expressions for quantum corrections to classical time correlation functions is considered. Presented is a phase space reformulation of quantum symmetrized and canonical correlation functions which does not invoke the Weyl correspondence by an analysis of the plane wave matrix element form of the traces of products of specified quantum operators. The correlation function expressions are then cast in a form convenient for displaying the classical limit and computing quantum corrections. An alternate phase space reformulation employing the Wigner equivalent technique is presented and shown to coincide with other previous results. The relationship of the WE method to the Weyl correspondence is discussed and phase space expressions for quantum hydrodynamic transport coefficients are presented. Dissert. Abstr.

N71-29177*# Translation Consultants, Ltd., Arlington, Va.
TRANSMISSION OF CHARGED PARTICLES BY A COMPOSITE-TYPE ANALYZER [PROPUSKANIYE ZARYAZHENNYKH CHASTITS ANALIZATOROM KOMBINIROVANNOGO TIPA]
S. A. Romanov et al Washington NASA Jun. 1971 44 p refs Transl. into ENGLISH of Acad. of Sci., USSR, Inst. for Space Res., Moscow, report, Pr-40
(Contract NASw-2038)
(NASA-TT-F-13617; Pr-40) Avail: NTIS CSCL 20H

An investigation of the transmission characteristics of a composite-type analyzer, which included as components electrostatic and magnetic analyzers of charged particles, was carried out by computer. The energetic and angular dependences of the cross sections S (alpha, beta, epsilon) of the device, the transmission integrals L (epsilon, epsilon sub O) in an isotropic beam of particles for various values of the operating potential of the device and the values epsilon sub O of the equilibrium energy of the particles corresponding to them, and also the values of the energy-geometrical coefficient as a function of epsilon sub O were obtained for three kinds of particles H(+), He(++), and He(+) by the Monte Carlo method. Author

N71-29180# Kansas Univ., Lawrence. Nuclear Structure Lab.
[EXPERIMENTAL AND THEORETICAL NUCLEAR RESEARCH] Progress Report, 1 Sep. 1969 - 31 Aug. 1970
[1970] 54 p refs
(Contract AT(11-1)-1120)
(COO-1120-117) Avail: NTIS

Progress in the experimental and theoretical nuclear research programs of the University of Kansas in the period Sept. 1, 1969 to August 31, 1970 is reported. The experimental equipment and facilities are described. NSA

N71-29182# Parke Mathematical Labs., Inc., Carlisle, Mass.
RESEARCH ON RADIATION EFFECTS IN SOLIDS Final Report, Jan. 1968 - Dec. 1970
Dec. 1970 18 p refs Sponsored in part by DASA
(Contract F19628-68-C-0188)
(AD-720274; Rept-0188-FR; AFCRL-71-0064) Avail: NTIS CSCL 18/8

The report contains a complete list of publications issued under the contract and some specific recommendations for extension of the work. Contents include the following: Theory of High energy induced low energy secondary emission; Theory of electron slowing down; Energy deposition in cavities and near boundaries; and, Mathematical models of radiation damage in silicon. GRA

N71-29186# Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Neutronenphysik und Reaktortechnik.
COMMENTS ON THE CALCULATION OF REACTION RATE TRAVERSES
E. Kiefhaber Nov. 1970 35 p refs Sponsored in part by US/Eurstom
(EURFNR-874; KFK-1314) Avail: AEC Depository Libraries

The influence of calculational methods and some changes in the nuclear data on the calculated reaction rate traverses is analyzed. As an example the traverses for U-235 fission and U-238 capture and fission in the assembly SNEAK 3A2 are studied. Besides some sensitivity studies the adequacy of the use of a global buckling for the separated direction in one dimensional calculations is checked by two dimensional calculations. The influence of reflecting zones outside the blanket was determined. The effects of applying heterogeneity-corrected group constants, the REMO-correction, two different types of transport cross sections and two different forms for the energy dependence of the fission spectrum are studied. No major deficiency in the generally used calculational methods was found so that the existing discrepancies between theory and experiment must be caused either by errors in the measurements or more probably by deficiencies in the nuclear data. Author (NSA)

N71-29188# Institute of Nuclear Research, Warsaw (Poland).
EFFECT OF RESIN CROSS-LINKING ON ANION EXCHANGE SEPARATION OF RARE-EARTH-EDTA COMPLEXES
R. Dybczynski 1970 37 p refs Submitted for publication
(INR-P-1209) Avail: AEC Depository Libraries

Anion exchange separation of the rare earth complexes with EDTA on Dowex 1 resins with 2, 4, 8, 10, and 16 nominal crosslinks, respectively was investigated at tracer loadings. Selectivity coefficients, separation factors, plate heights, and resolutions for adjacent peaks were calculated from the elution curves. Although separation factors increased rather uniformly with

the increase in resin crosslinking, best separations were obtained with Dowex 1 × 4 due to the most promising value of the plate height. Plate height, which was the lowest for X4 resin, was found to increase both with increase and decrease of resin crosslinking. The change from X4 to X16 resin resulted in drastic increase of plate height by nearly two orders of magnitude. It was found that the results obtained cannot be interpreted on the grounds of the classical Glueckauf equation. The introduction of a new term, accounting for longitudinal diffusion in the resin phase, into Glueckauf's equation was suggested and the qualitative agreement between theoretical prediction and experimental data was demonstrated. Author (NSA)

N71-29190# Brown Univ., Providence, R.I. Dept. of Physics.
USE OF COLLINEAR AND DOUBLE O(2,1) VARIABLES FOR SINGLE PARTICLE SPECTRA
Chung-I Tan [1970] 10 p refs Submitted for publication Sponsored by AEC
(NYO-2262-TA-229) Avail: NTIS

Various different sets of variables used for single particle inclusive experiments are grouped into two general types. The first type specifies momenta in collinear frames; and the other, double O(2,1) variables, specifies momenta in the rest frame of the produced particle. Advantages of each set of variables are briefly mentioned. Useful relations, exact as well as asymptotic, between various sets are provided. Author (NSA)

N71-29191# Texas A&M Research Foundation, College Station.
RESEARCH IN CHARGED PARTICLE ACTIVATION ANALYSIS Progress Report, 1 Feb. 1970 – 31 Jan. 1971
E. A. Schweikert 29 Jan. 1971 66 p refs
(Contract AT(40-1)-3922)
(ORO-3922-2) Avail: NTIS

Possible interfering reactions in the alpha, deuteron, and helium-3 activation determination of carbon were surveyed. Sub-ppM C determinations were carried out on high-purity Si. Detailed activation curves were obtained for deuteron- and proton-induced reactions in the determination of S and Cl. Studies were continued on the development of a technique for probing impurity distribution in samples using a beam of varying energy. An activation curve for (C-12)(d,n)N-13 was established using mylar foils irradiated with a beam diffusion through the foil in different positions. Preliminary tests on impurity distributions were run with a beam of 10-MeV protons using the reaction (C-12)(p,p')C-12* and measuring the 4.4-MeV gamma ray. Studies were initiated on activation methods for the production of short-lived radioisotopes to be used for on-line detection of impurities. Preliminary work is underway on defining experimental conditions for the exploitation of inelastic scattering reactions using protons up to 10 MeV. NSA

N71-29192# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
RELATION BETWEEN THE CROSS SECTIONS OF THE PROCESSES ELECTRON PLUS POSITRON YIELDS ELECTRON PLUS POSITRON PLUS A(−) PLUS A(+) AND GAMMA PLUS GAMMA YIELDS A(−) PLUS A(+)
P. S. Isaev and V. I. Khleskov 1971 12 p refs In RUSSIAN
(JINR-P2-5505) Avail: AEC Depository Libraries

A connection between the cross section is established in the lower order of perturbation theory. The kinematics of the collision process is chosen such that the virtual space-like photon is very close to the real photon. It means that the mass of the virtual photon is close to zero. The transversality condition of the virtual photon should be added to eq. (I). This can be made by comparing the polarization matrix of the gamma + gamma yields positive A + negative A process with the polarization matrix of the positive A + negative A pair creation process in the collision of the virtual photons. The gamma + gamma interaction can be studied by using the relation between the two cross sections mentioned. Author (NSA)

N71-29193# Stockholm Univ. (Sweden). Research Inst. for Physics.
[EXPERIMENTS WITH ACCELERATOR BEAMS] Annual Report, 1969
I. Bergstroem, ed. Dec. 1969 192 p refs
(NP-18671) Avail: AEC Depository Libraries

The technical efforts were concentrated on pulsing the external beams in the time regions between the natural pulse distance of about 125 ns and 10 s. The possibility of supplying nearby hospitals with shortlived radioactive isotopes which cannot be produced in reactors was investigated. The joint OSIRIS (isotope separator on-line the Studsvik reactor) project has continued. By joining the groups, a project of high international quality was realized. The heavy ion on-line isotope separator, PINGIS, was successfully tested for the first time in realistic experiments. The load on the isotope separator for studies of atomic lifetimes and for making ion implanatation in semiconductors was large. The van de Graaff machine mainly was used for the localization of ions implanted in Ge and Si and electrical measurements on ion implated semiconductors. The double focusing 50 cm beta spectrometer was used for continued studies of beta decay of tritium. Author (NSA)

N71-29194# Centralny Instytut Informacji Naukowo-Technicznej i Ekonomicznej, Warsaw (Poland).
NUKLEONIKA
1970 75 p refs Transl. into ENGLISH from the book "Nukleonika" Poland, v. 14, 1969 p 1185–1262 Sponsored by AEC and NSF
(AEC-tr-7027/12; TT-69-50012/12) Avail: NTIS

A detailed review is given of Polish nuclear studies with reference to a short history of the science in Poland. The review includes studies of the dynamics and structure of solids by neutronographic methods, radiometric analysis as applied to geology and mining, and achievements in pure and applied radiation chemistry. E.H.W.

N71-29196# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).
RESEARCH REPORT ON THE MEASUREMENT OF THE AVERAGE NUMBERS OF PROMPT NEUTRONS AND OF THE RELATIVE CROSS SECTIONS FOR THE FISSION OF U-235 AND Pu-239 INDUCED BY NEUTRONS WITHIN THE 0.3 AND 1.4 MeV ENERGY RANGES
M. Soleilhav et al Oct. 1970 21 p refs Transl. into ENGLISH of French report
(LIB-Trans-300) Avail: AEC Depository Libraries

The existence of a structure below 0.7 MeV for the average number of prompt neutrons =f(E) in U-235 was confirmed, and evidence was obtained of another hump between 0.7 and 1.4 MeV. For Pu-239 the average number of neutrons = f(E) was very close to a straight line with the possibility of a slight hump near 0.4 MeV. The fission cross section for Pu-239/U-235 was obtained and approximated that obtained by Davey (1968). Divergence above this value was attributed to lack of data for the 1 to 1.5 MeV region hitherto. Time-of-flight spectra for fissions induced by the neutrons from Li-7(p,n)Be-7 with 2.7 MeV protons are shown. NSA

N71-29197 Washington Univ., Seattle.
THE MAGENTIC MOMENT OF THE POSITIVE SIGMA HYPERON
James R. Benbrook (Ph.D. Thesis) 1969 286 p
Avail: Univ. Microfilms Order No. 70-14734

The magnetic moment of the positive Sigma hyperon has been measured in this experiment. A total of 1777 positive Sigma hyperons were produced in the reaction positive pion + proton yields positive kaon + positive Sigma hyperon at a positive pion momentum of 1280 MeV/c. The positive kaon and the positive Sigma hyperon and its decay proton were observed in a small

optical spark chamber located inside the bore of a solenoidal pulsed magnet. The measurement of the precession of the asymmetric decay distribution from the polarized 955 field on positive Sigma hyperon events yields a number of 2.68 + or − .97 nuclear magnetons . The average polarization of the whole sample of 1777 events is −.558 + or − .039. Dissert. Abstr.

N71-29198# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.

INVESTIGATION OF PAIR CORRELATIONS OF THE SUPERCONDUCTING TYPE IN NUCLEI WITH A GREATER THAN 100 USING THE SAXON−WOODS POTENTIAL

A. I. Vdovin, A. L. Komov, and L. A. Malov 1970 18 p refs In RUSSIAN

(JINR-P4-5125) Avail: AEC Depository Libraries

The dependence of the pair correlation constant on the atomic weight A, nuclear deformation and other values is investigated. The calculations were performed using the Saxon−Woods potential. It is shown that for the region 100 < A < 250 the constants G sub N and G sub Z are represented in terms of the increase of the nuclear surface due to deformation and the atomic weight. Author (NSA)

N71-29199# Academia R. P. R., Bucharest. Inst. de Fizica Atomica.

HARTREE-FOCH CALCULATIONS IN LIGHT NUCLEI

I. Guiasu, M. Iosifescu, H. Scutaru, and M. Cristu 1969 13 p refs

(IFA-FT-78) Avail: AEC Depository Libraries

Hartree−Fock calculations for even nuclei in the 1p shell were performed by using the matrix elements of the nucleon−nucleon interaction extracted by Elliott et al. In H.F. approximation binding energies for the Elliott potential are larger than those obtained with the Tabakin potential. All solutions of the H.F. equation were obtained. The Slater determinants corresponding to the two H.F. minima in C-12 are very close to the solutions of an exact diagonalization of the Hamiltonian on the basis that has been used in the H.F. calculations. Author (NSA)

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N71-28032*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.

SUMMARY OF THE ACTIVITY IN PLASMA PHYSICS AT THE UNIVERSITY OF IOWA Annual Status Report, Jun. 1970−Jun. 1971

Jun. 1971 11 p refs

(Grant NGL-16-001-043)

(NASA-CR-118991) Avail: NTIS CSCL 20I

Abstracts of theoretical and space physics papers are presented. Author

N71-28173*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

PARTITION FUNCTIONS AND EQUATIONS OF STATE IN PLASMAS

W. M. Sparks and D. Fischel Washington 1971 617 p refs

(NASA-SP-3066) Avail: NTIS HC $9.00/MF $0.95 CSCL 20I

Theoretical gas characteristics of plasmas of seven different chemical compositions were calculated and are presented in tabular form. The seven cases are six pure gases (H, He, N, O, Ne, and Ar) and the solar chemical composition. All data are tabulated for 10 electron pressures from .01 dyne/sq cm to 10 million dyne/sq cm and for 50 temperatures from 3000 K to 150,000 K. The tables include electron density, particle density, the number of free electrons per atom, the number of negative hydrogen ions per hydrogen atom, mass density, gas pressure, the equation of state parameter, the degeneracy parameter, the ionization energy per gram, the ionization plus excitation energy per gram, the total energy per gram, the partition functions, the ionization fractions, and the depression of the ionization potentials. Author

N71-28839*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

PROBE AND RADAR ELECTRON TEMPERATURES IN AN ISOTROPIC, NONEQUILIBRIUM PLASMA

W. R. Hoegy Apr. 1971 25 p refs Submitted for publication

(NASA-TM-X-65586; X-621-71-202) Avail: NTIS CSCL 20I

Electron temperatures measured by electrostatic probes and radar backscatter are proved to be distinct physical quantities with the temperature from each technique determined from a different moment of the electron distribution function. Further, numerical inequality of temperatures results from a non-Maxwellian electron distribution function or equivalently, a nonequilibrium electron plasma. Probe and backscatter electron temperatures are studied for low and high energy (isotropic) distortions of the distribution function. The nonequilibrium plasma generally produces higher probe than backscatter temperatures, however the temperature difference is small for distortions due to realistic photoelectron fluxes. It is concluded that if large temperature differences occur in the ionosphere, both probe and backscatter temperatures would differ from the temperature characterizing the average electron kinetic energy, and a single temperature applicable to a variety of physical processes would no longer exist. Author

N71-28745# Johns Hopkins Univ., Baltimore, Md. Applied Physics Lab.

ON SOME FEATURES OF PLASMA FLOW FROM A DISCHARGE IN A MAGNETIC FIELD OF UP TO 100 kOe

M. D. Gabovich et al 18 Jan. 1971 14 p refs Transl. into ENGLISH from Ukr. Fiz. Zh. (Kiev), v. 13, no. 12, 1968 p 1977−1982

(Contract N00017-62-C-0604)

(AD-721313; APL-CLB-3-T-633; CLB-3T-633) Avail: NTIS CSCL 20/9

It is shown that a nonmonotonic dependence of the intensity of the ion component of an outflowing plasma on the magnetic field strenth as well as the formation of a tubular plasma flux can be observed when plasma flows from a hot-cathode discharge in a magnetic field of up to 100 kOe. A large radial electric field is localized in the discharge zone opposite the outlet. An interpretation of this phenomenon is given. Author (GRA)

N71-28818*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

MEASUREMENT OF ELECTRON DENSITY OF A NEGATIVE-GLOW PLASMA WITH AN E-BAND FABRY-PEROT INTERFEROMETER

Bruce M. Kendall (M.S. Thesis−George Washington Univ., Washington, D.C.) Washington Jun. 1971 43 p refs

(NASA-TN-D-6282; L-7656) Avail: NTIS CSCL 20I

Electron density measurements of a negative-glow plasma were made at E-band (60 to 90 GHz) with a Fabry−Perot interferometer. These measurements demonstrated the validity of the technique of using a flat plate Fabry−Perot interferometer, which provided a closer approximation to plane wave theory than the spherical mirror resonators previously used for electron density measurement. In addition, this technique provides for the analysis of inhomogeneous plasma with a parabolic distribution of electron density, which has not been reported previously. Measurements made at separate frequencies of 60.3, 76.6, and 89.1 GHz demonstrated to within a factor of 2 the frequency independence

and repeatability of the measurement technique. Also, the results of the Fabry–Perot interferometer measurements agreed well with those obtained independently for the same plasma with an X-band and K-band microwave interferometer. A comparison between the derived equations of electron density for the assumed homogeneous plasma slab and the inhomogeneous plasma with parabolic distribution show that the slab approximation is valid for such an electron density profile. Author

N71-28840# Maryland Univ., College Park. Dept. of Physics and Astronomy.

APPLICATION OF LIGHT SCATTERING TO PLASMA DIAGNOSTICS Progress Report

Nov. 1970 71 p refs

(Contract AT(40-1)-3393)

(ORO-3393-5) Avail: NTIS

Research results are presented on the following topics: (1) collisionless coupling between plasmas and magnetic fields in a high-voltage theta pinch, (2) experimental rate coefficients for collisional excitation of lithium-like ions, (3) measurement of excitation rate coefficients for beryllium-like ions, and (4) light scattering from high-density plasmas. Author (NSA)

N71-28841# Innsbruck Univ. (Austria). Inst. for Theoretical Physics.

LITERATURE SURVEY ON PLASMA INSTABILITIES. VOLUME 1: REPORTS

Gerhard Auer, Ferdinand Cap, Dietmar Floriana, and Herbert Gratzl 31 Dec. 1970 180 p refs

(Contract F61052-70-C-0014)

(AD-722085; UNICP-SR-75; AFOSR-TR-71-0608; SR-75) Avail: NTIS CSCL 20/9

The report is the first volume of a literature survey on the largely extended field of plasma instabilities. Among other references the 1968 - 1970 issues of almost 40 relevant journals were looked through systematically. The first volume contains 121 more or less comprehensive single reports surveying all plasma instabilities which came to the authors knowledge. Both, experimental observations as well as theoretical models of the instabilities are presented. A subject index (list of instabilities) enables the reader to find the survey report on a special instability. The abstracts of the references cited in this first volume will be presented in a second volume. Author (GRA)

N71-28848# Boston College, Chestnut Hill, Mass. Space Data Analysis Lab.

POSITIVE ION DENSITIES FROM A ROCKET BORNE HEMISPHERICAL LANGMUIR PROBE: 40 TO 100 KM Final Report, 1 Jun. 1967–31 May 1970

Edward N. Richards 30 Jun. 1970 57 p refs Sponsored in part by DASA, Washington

(Contract F19628-67-C-0326)

(AD-722066; AFCRL-71-0145) Avail: NTIS CSCL 4/1

The positive ion current to a rocket borne hemispherical electrostatic (Langmuir) probe is determined in terms of the ambient density for altitudes extending through the collision and free molecular flow regimes. In the free molecular flow regime (above 70 km.) the probe velocity is assumed to be sufficiently greater than the mean ion thermal velocity so that a cold plasma may be assumed. Charge trajectories to the probe are then calculated for small angle of attack, yielding a maximum impact parameter for a charge to strike the probe. An effective probe cross section is computed from this impact parameter. In the collision regime, below 60 km, the effects of convection due to supersonic neutral gas flow in the probe frame of reference, and of charge drift due to electrical mobility are examined. The basic features of the neutral gas flow behind the supersonic shock are analyzed leading to the conclusion that the flow velocity is great enough so that charge separation may be neglected except in a small region near the stagnation point. On this basis the total current to the probe is approximated by a simple mobility formula. The results are used to analyze positive ion currents from 40 to 100 km obtained during a P.C.A. event. Author (GRA)

N71-28881# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany)

LINEAR EXPERIMENT WITH I EQUALS 1 ON THE HIGH-BETA-STELLERATOR ON ISAR 1 [EXPERIMENTE MIT EINEM LINEAREN I EQUALS 1 HOCH-BETA-STELLARATOR AN ISAR]

M. Kaufman, E. Fuenfer, J. Junker, and J. Neuhauser Aug. 1970 23 p refs In GERMAN; ENGLISH summary

(IPP-1/111) Avail: AEC Depository Libraries

In preparation for a toroidal high-beta stellarator, a linear experiment with helical l = 1 symmetry was made on the ISAR-I theta pinch. The fast theta-pinch-like shock heating in the presence of a helical field and the buildup of a plasma column were investigated. It could be seen that the plasma formed a screw near the axis of the vacuum magnetic field. Neither rapidly growing instabilities nor enhanced diffusion was found. Author (NSA)

N71-28916# Brandeis Univ., Waltham, Mass. Dept. of Physics.

RESEARCH IN THEORETICAL ASTROPHYSICS Final Scientific Report, 4 Oct. 1968–15 Oct. 1970

Jack S. Goldstein, Gabor Kalman, and Pradip Bakshi Jan. 1971 20 p refs

(Contract F19628-69-C-0074)

(AD-721668; AFCRL-71-0112) Avail: NTIS CSCL 3/2

A description is presented of research carried out in several fields of plasma physics, including work on very dense plasmas Rho greater than one million g/cc, linear and nonlinear effects, magneto-plasmas and zero B-field plasmas. Bulk properties such as conductivity, radiation, etc. have been calculated. A study of relativistic shock waves in dense degenerate plasmas has resulted in the calculation of the dissipation by neutrino emission of such shocks. The (gravitational plasma), as exemplified by globular star clusters, etc., has been studied, and a variety of distribution functions corresponding to observed density distributions has been obtained. Field theoretic approaches to plasma physics, including calculation of equations of state, have been explored. Calculations have been made for the scalar interactions. Fusion chain reactions in stars have been calculated. Plasma confinement studies have been carried out in conjunction with experiments being performed at AFCRL. Author

N71-28986# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.

GYRO RESONANCE OF SUPRATHERMAL ELECTRONS IN A COLLISIONLESS PLASMA

B. L. Gotwols Oct. 1970 75 p refs

(Contract N00017-62-C-0604)

(AD-721337; APL-TG-1135) Avail: NTIS CSCL 3/2

Equations for the absorption coefficient and emissivity due to a tenuous component of suprathermal electrons gyrating in a magnetoactive plasma are given. An example is presented for the case where the plasma and gyro frequencies are equal, in order to illustrate the large magnitude (both positive and negative) and narrow bandwidth of the absorption coefficient when the complex doppler effect comes into play. Maximum growth rate is found when the wave normal makes a small angle (< 10 degrees in the example) with the background magnetic field. It is pointed out that the large value of the longitudinal electric field makes uncertain, without further analysis, the intensity of the radiation which can escape from the plasma. A numerical example is given where the gyro frequency exceeds the plasma frequency, and the electrons exhibit an anisotropic momentum distribution function. The resultant negative absorption coefficient is shown to be plausible as a generation mechanism for the narrow bandwidth component of

decimetric wavelength solar bursts. The relevance of amplified gyro radiation as an explanation for Type I bursts is discussed. Author (GRA)

N71-29026*# Translation Consultants, Ltd., Arlington, Va.
INVESTIGATION OF ORDINARY WAVES IN A CHEW, GOLDBERGER, AND LOW APPROXIMATION [ISSLEDOVANIYE PROSTYKH VOLN V PRIBLIZHENII CHU, GOLDBERGERA I LOU]
V. B. Baranov Washington NASA May 1971 18 p refs Transl. into ENGLISH from the Russian report
(Contract NASw-2038)
(NASA-TT-F-13612; PR-23) Avail: NTIS CSCL 20I

The Chew, Goldberger, and Low hydrodynamic equations for collisionless plasma are used to investigate ordinary waves. The integral curve field for fast and slow magneto-sonic waves is investigated in detail. It is shown that in a fast magneto-sonic wave the magnetic field increases with increase in density, just as is the case in magnetohydrodynamics with isotropic pressure. The slow magneto-sonic wave has a region in which the magnetic field drops to the compression wave, as well as an anomalous region in which the sign of the derivative changes. It is shown that fast and slow magneto-sonic waves have a tendency to flip in certain special cases (low pressures and propagation of the wave almost perpendicular to the magnetic field). Author

N71-29087*# Scientific Translation Service, Santa Barbara, Calif.
THE PRESENT STATE OF THE QUESTION OF TURBULENT ELECTROCONDUCTIVITY IN PLASMA AND CERTAIN QUESTIONS RELATED TO THE DYNAMICS OF THE MAGNETOSPHERE, 1 [SOVREMENNOYE SOSTOYANIYE VOPROSA O TURBULENTNOY ELEKTROPROVODNOSTI V PLAZME I NEKOTORYYE VOPROSY DINAMIKI MAGNITOSFERY, 1]
V. A. Liperovskiy Washington NASA May 1971 54 p refs Transl. into ENGLISH of Acad. of Sci. USSR, Inst. for Space Res., Moscow, report Ob-5
(Contract NASw-2035)
(NASA-TT-F-13610; Ob-5) Avail: NTIS CSCL 20I

Phenomena related to plasma turbulence in the circumsterrestrial region of space are considered, and concepts related to turbulent electroconductivity are surveyed. Laminar and turbulent electroconductivity of a plasma are discussed. Relations for a turbulent current are estimated, and theoretical concepts related to a plasma in a strong electric field are presented. Author

N71-29181* National Academy of Sciences-National Research Council, Washington, D.C.
CONVERGING BARREL PLASMA ACCELERATOR Patent
Dah Yu Cheng, inventor (to NASA) Issued 18 May 1971 5 p Filed 23 Oct. 1968 Cl. 315-111; Cl. 313-155; Cl. 313-161; Cl. 313-231; Int. Cl. H01j1/50; Int. Cl. H01j7/24; Int. Cl. H05b1/00
Sponsored by NASA
(NASA-Case-ARC-10109; US-Patent-3,579,028; US-Patent-Appl-SN-789998) Avail: US Patent Office CSCL 20I

The invention comprises a device for generating and accelerating a plasma to extremely high velocity while the device will also focus the plasma to a decreasing cross section for attaining a very dense high velocity plasma burst capable of causing nuclear fusion reactions. A converging coaxial accelerator electrode configuration is employed with high pressure gas injection in controlled amounts to achieve acceleration by deflagration and focusing by the shaped electromagnetic fields. Official Gazette of the U.S. Patent Office

N71-29183*# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany).
COSMIC DUST IMPACT LOCATION DETECTOR Patent Application
Siegfried Auer, inventor (to NASA) 23 p Filed 29 Dec. 1970
Sponsored by NASA
(NASA-Case-GSC-11291-1; US-Patent-Appl-SN-102412) Avail: NTIS CSCL 20I

A system for detecting the impact position of cosmic dust and other similar outer space particles on a detector surface is described. The system includes a means for forming an ionized stream in response to impact of a particle. The ionized stream is collected by one of a multiplicity of mutually insulated, metal electrode strips. Also provided is a multiplicity of series connected capacitors, with taps between adjacent capacitors which are connected to a different one of each of the strips. Each end terminal of the series circuit formed by the capacitors is connected to input terminals of amplifiers which drive circuitry to indicate the strip on which the particle impacted. To prevent the plasma stream from impinging on a strip other than the strip in closest proximity to the source of the stream, shield walls are provided along the edges of the strips. NSA

N71-29184* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MAGNETICALLY CONTROLLED PLASMA ACCELERATOR Patent
Karlheinz Thom and Joseph Norwood, Jr., inventors (to NASA) Issued 1 Mar. 1966 4 p Filed 31 May 1962 Cl. 315-111
(NASA-Case-XLA-00327; US-Patent-3,238,413; US-Patent-Appl-SN-199199) Avail: US Patent Office CSCL 20I

Intensive efforts were made to improve the efficiency and effectiveness of the structure, performance characteristics, and mode of operation of a magnetically controlled plasma accelerator. The accelerator is magnetically ignited and is capable of operating in a low density gaseous environment. The accelerator also eliminates the necessity for a switching means in the high voltage circuit. E.H.W.

N71-29185 Illinois Univ., Urbana.
PROPERTIES OF FREE JETS OF IONIZED NITROGEN
Donald Joseph Myronuk (Ph.D. Thesis) 1969 125 p
Avail: Univ. Microfilms Order No. 70-13427

The results of an experimental study to measure temperatures and electron densities of a free jet of ionized nitrogen gas at atmospheric pressure are presented. A spectroscopic method that utilized the 4955 A continuum radiation of nitrogen to investigate the exhaust plume of a plasma jet of a simple design, yielded gas temperatures in the range of 9000 K to 15,800 K and electron densities in the range of 5 × 10 cu cm to 10 to the 17th power/cu cm. Nitrogen mass flow rates were 0.05 and 0.1 grams per second with arc currents of 200 and 300 amperes. The study made possible an estimation of Prandtl numbers which included radiation effects and ranged in value from 0.06 to 0.75 in the free jet. There is general agreement between these values and other available data in the temperature range of 2000 to 12,000 K. A value of the order of 12 was determined for the jet spread parameter associated with free jets. Dissert. Abstr.

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N71-29029*# Instituto de Energia Atomica, Sao Paulo (Brazil).
DESCRIPTION OF SANDSTONE OVEN FOR IRRADIATION OF SAMPLES IN A REACTOR AND MEASUREMENT OF THEIR ELECTRICAL RESISTANCE [DESCRICAO DO FORNO GRESIL I PARA IRRADIACAO DE AMOSTRAS NO REATOR E MEDIDA DE SUA RESISTENCIA ELECTRICA]
Philipe Brosson, George Luchi, Harcilio Rechenberg, Laura Sordi, and Raphael Tiberghien May 1970 20 p In PORTUGUESE

ENGLISH summary
(IEA-212) Avail: AEC Depository Libraries

An apparatus for measuring electric resistivity in short wire samples is described. Using this device, it is possible to expose the samples to neutron irradiation (swimming pool reactor) and to follow the evolution of their resistivity. The oven in which the sample is placed is described. Thermal treatment is selectable between 100 and 600 C, allowing a variety of studies in solid state physics to be conducted. Author (NSA)

N71-28043# Royal Aircraft Establishment, Farnborough (England).
THE PLASTIC DEFORMATION OF POLYCRYSTALS [DIE PLASTISCHE VERFORMUNG VON VIELKRISTALLEN]
Eckard Macherauch Feb. 1971 62 p refs Transl. into ENGLISH from Z. Metallk. (Stuttgart), v. 55, no. 2, 1964 p 60-82 Presented at the Ann. Meeting of the Ger. Soc. of the Sci. of Metals, Berlin, 11 Jun. 1963
(RAE-LIB-TRANS-1532) Avail: NTIS

Selected topics in the field of plasticity of polycrystals are presented. These are: (1) differences between plastic deformation of single and polycrystals, and the effect of grain boundaries and the work hardening behaviour of single, bi- and poly-crystals, (2) deformation inside the grains of polycrystalline materials using data obtained by slip-line studies, transmission electron microscopy and X-ray studies; (3) results of experiments on f.c.c. and b.c.c. metals, especially the discontinuous yielding phenomenon observed in iron and in recent investigations of group V.A- and VI.A-metals; and (4) a survey of different attempts to calculate the work-hardening curve in polycrystalline f.c.c. materials. Author

N71-28122*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SUPERCONDUCTING PROPERTIES OF NIOBIUM FILMS
Wayne R. Hudson and Russell J. Jirberg Washington Jun. 1971 25 p refs
(NASA-TN-D-6380; E-6206) Avail: NTIS CSCL 20L

Critical currents as a function of magnetic field, film thickness, and film orientation have been studied for 14 niobium films ranging in thickness from 16.2 to 1153 nanometers (162 to 11,530 A). All measurements were made at 4.2 K. Measurements of the critical current with respect to the angle between the surface of the film and the magnetic-field direction revealed that a sharp critical current maximum occurs when the magnetic field is parallel to the film surface. For films thicker than 88.0 nm a broad maximum in the critical current was also observed when the orientation of the magnetic field was nearly perpendicular to the film. Films with a thickness between 25.0 and 60.0 nm carried the highest current densities in large magnetic fields. The ratio of the parallel critical magnetic field to the perpendicular critical magnetic field was less than 1.69 for films where the thickness was much greater than the coherence length. When the thickness was on the order of the coherence length the ratio was greater than 1.69 at 4.2 K. Author

N71-28203# Naval Research Lab., Washington, D.C. Transformations and Kinetics Branch.
THE CHEMICAL POLISHING AND ETCH PITTING OF SAPPHIRE
R. G. Vardiman *In its* Rept. of NRL Progr., Apr. 1971 p 7-13 refs (See N71-28201 16-34)
Avail: NTIS

Three dislocation etchants, H3PO4, KOH, and KHSO4 and two chemical polishes, H3PO4 and Na2B4O7 were investigated as to their effective temperature and orientation ranges on sapphire. In addition, the etchants are compared for effectiveness of dislocation pitting. It is found that the best pitting is obtained with KHSO4 on the 1120 plane and KOH on the (001) plane. Author

N71-28227# Pennsylvania State Univ., University Park. Dept. of Engineering Mechanics.
A GENERAL THEORY OF INTERACTION OF DISCRETE ELASTIC DEFECTS
Jen Hsu Lee and Walter Jaunzemis Feb. 1971 59 p refs
(Grant AF-AFOSR-1626-69)
(AD-721469; TR-2; AFOSR-TR-71-0479) Avail: NTIS CSCL 20/12

The investigation is intended as a first step towards continuum theories of interacting defects (e.g. inclusions, dislocations). These theories would deal with aspects of local nonhomogeneity that influence strength, ductility, and other vital properties of materials. The unified approach to interactions of defects applies to both rigid and deformable defects. The following special cases are used as illustrations: Rigid dislocation loops, Rigid inclusions, Image forces, Expansion of a dislocation loop, Helical dislocations, and The equilibrium shape of a dislocation line. Author (GRA)

N71-28228# California Univ., Los Angeles. Dept. of Chemistry.
OPTICAL DETERMINATION OF THE ELECTRON SPIN-LATTICE RELAXATION MECHANISMS BETWEEN THE ZERO FIELD LEVELS OF THE LOWEST TRIPLET STATE
L. H. Hall and M. A. El-Sayed Mar. 1971 7 p refs *Its* Contribution No. 2775
(Contract N00014-69-A-0200-4012)
(AD-721360; TR-7) Avail: NTIS CSCL 7/4

Very little work has been carried out on the mechanism of the spin lattice relaxation (SLR) processes between the Zeeman levels of the lowest triplet state of molecular impurity in molecular solids. Studies in zero field (zf) on the temperature dependence, and thus the mechanisms, of tau(1e) amongst the zf levels of the lowest triplet state have not been made for molecular solids. In the report, the authors present the results on the variation of the SLR rate constants (1/tau(1e)) with temperature using optical techniques in zf. Conclusions are made concerning the mechanisms of the SLR processes between the zf levels of the lowest triplet state of pyrazine-d4 in the temperature range 1.5-7.9K. Author (GRA)

N71-28243# Toulouse Univ. (France). Faculte des Sciences.
CONTRIBUTION TO THE STUDY OF LOW FREQUENCY BACKGROUND NOISE OF INSULATED GRID FIELD EFFECT TRANSISTORS [CONTRIBUTION A L'ETUDE DU BRUIT DE FONDE BASSE FREQUENCE DES TRANSISTORS A EFFET DE CHAMP A GRILLE ISOLEE]
Jose Depis (Ph.D. Thesis) Apr. 1969 167 p refs In FRENCH
Avail: NTIS

The correlation between LF noise and surface properties in semiconductors is analyzed. The experimental design for noise measurement is described and results for several types of metal oxide semiconductors are presented. A model is designed from these results. ESRO

N71-28244# Toulouse Univ. (France). Faculte des Sciences.
MATHEMATICAL MODEL OF A MOS TRANSISTOR SUBMITTED TO HIGH ENERGY RADIATIONS [MODELE MATHEMATIQUE DU TRANSISTOR MOS SOUMIS AUX RAYONNEMENTS DE GRANDE ENERGIE]
Jean-Louis Giraud (Ph.D. Thesis) Feb. 1970 122 p refs In FRENCH Sponsored by CEA
Avail: NTIS

A mathematical model is designed to predict the electrical behavior of metal oxide semiconductors under high energy, (electron, proton, neutron) irradiation. The model has proved to give results in good agreement with experimental measurements. ESRO

N71-28287# Technion-- Israel Inst. of Tech., Haifa.
PROPERTIES OF ELECTRON GAS IN CONSTANT MAGNETIC AND ELECTRIC FIELDS Final Technical Report, Oct. 1969 - Sep. 1970
J. Zak Sep. 1970 9 p refs
(Contract DAJA37-70-C-0547)

(AD-721311; ARDG-E-E-1282) Avail: NTIS CSCL 20/12

The motion of electrons in perturbed crystals was investigated. The research concentrated on two problems: the impurity problem in semiconductors and the dynamics of a Bloch electron in a constant electric field. In both problems the treatment was based on the kq-representation. For the impurity problem in semiconductors a significant improvement in the agreement between theory and experiment was achieved by taking into account the higher order effects in the variation of the impurity potential. The second order effect was explicitly evaluated for acceptors in Ge and an agreement with experiment was obtained. For the problem of a Bloch electron in an electric field the energy spectrum and wave functions were calculated for a finite range crystal. The oscillations of a Bloch electron in an electric field were reconsidered on the basis of the kq-representation, and it was shown that no such oscillations exist.

Author (GRA)

N71-28332# Stanford Univ., Calif. Electronics Lab.

PHOTOEMISSION FROM GERMANIUM SINGLE CRYSTALS

Junji Matsuzaki Dec. 1970 32 p refs

(Contract DA-31-124-ARO(D)-430; ARPA SD-87)

(AD-721318; SU-SEL-70-084; TR-5220-3) Avail: NTIS CSCL 20/12

Studies of band structure of germanium by using photoemission have been reported recently by Donovan and Spicer and Donovan. Some new experimental results of electronic structures of simple crystal germanium are presented here. Principal results are as follows: The Gamma 15 levels relative to the Gamma 25 valence band maximum was determined to be 2.93 plus or minus 0.05 eV by using derivative of energy distribution curves. The spin-orbit splitting of the Gamma 25 level was found to be 0.27 plus or minus 0.05 eV. The L2 level was determined to be 8.2 plus or minus 0.2 eV. The peak levels for the band delta 2 and the band Sigma 3 were estimated to be 3.2 plus or minus 0.2 eV and 2.5 plus or minus 0.2 eV, respectively. Author (GRA)

N71-28333# Minnesota Univ., Minneapolis. Dept. of Chemical Engineering and Materials Science.

SUPERCONDUCTING PROPERTIES OF TRANSITION METAL CARBIDES AND NITRIDES Final Report

L. E. Toth Mar. 1971 8 p refs

(Grant AF-AFOSR-1369-68)

(AD-721664; AFOSR-71-0856R) Avail: NTIS CSCL 20/12

During the last two years of this project research was continued on the superconducting and electrical properties of transition metal carbides and nitrides. Perhaps the most important achievement of the period was the continued development on thin films of niobium nitride. Additional studies were continued on the electron density of states in these materials as determined by low temperature heat capacities and magnetic susceptibilities. Most of the work was focused on VC and TiC alloys. Research was also begun on augmented plane wave calculations of the electron density of states in refractory materials such as carbides, nitrides and borides. Author (GRA)

N71-28557# Lincoln Lab., Mass. Inst. of Tech., Lexington.

ADVANCED ELECTRONIC TECHNOLOGY Quarterly Technical Summary, 1 Nov. 1970 – 31 Jan. 1971

Melvin A. Herlin and Alan L. McWhorter 15 Feb. 1971 26 p

(Contract F19628-70-C-0230)

(AD-722076; ESD-TR-71-15) Avail: NTIS CSCL 9/2

The document contains reports on Data systems and solid state technology. The reports on digital computers include Integrated circuit development, Photolithographic interconnection of plastic-imbedded semiconductor chips, Semiconductor testing, Magnetic film engineering, and Computer applications. The section on Psychology includes Reckoner/mediator and other work. A report on computer systems is also included. In the field of advanced electronic technology the report covers solid state device research, materials research, physics of solids, and microelectronics.

Author (GRA)

N71-28559# Office of Naval Research, London (England).

SOME LOW TEMPERATURE RESEARCH (SUPERCONDUCTIVITY) AT THE UKAEA

Robert A. Hein 12 Feb. 1971 26 p refs

(AD-720683; ONRL-R-2-71) Avail: NTIS CSCL 20/12

The report describes some of the research and development work concerned with superconducting materials and devices currently under way at the UKAEA in-house laboratories at Harwell and Culham. Included in the report is some work concerned with magnetic alloys. Author (GRA)

N71-28559# Chicago Univ., Ill. Dept. of Physics.

APPLICATION OF PHOTON ECHO RESONANCE TO PROBLEMS IN SOLID STATE AND OPTICAL PHYSICS Final Technical Report, 1 Dec. 1965 – 30 Jun. 1969

Isaac D. Abella Sep. 1970 36 p refs

(Contract DA-31-124-ARO/D-4261)

(AD-721310; AROD-6266-4-P) Avail: NTIS CSCL 20/12

The basic experimental phenomenon of photon echo resonance consists of applying two brief laser pulses, separated by a time tau, to a resonant absorbing system. In the work discussed, the source is a liquid nitrogen cooled ruby laser, Q-switched by Kerr-cell, while the absorbing media are samples of ruby. The target system responds by emitting an echo pulse at time 2 tau whose amplitude is characteristic of the state of phase coherence. The echo is detected by a photomultiplier and suitably displaced. Thus, such phase disrupting phenomena as lattice vibration, i.e., phonon excitation, or magnetic interactions with the same, or different species of atom, contribute to the echo decay. The original proposal made in this contract, contained several programs of study, which have been successfully carried out. We proposed to study the magnetic properties of echo generation, which is described by Modulation of Echoes. We also proposed the study of concentration dependence and other temperature-independent decay. This is described in the body of the report as is the important advance in direct measurement of lifetimes of photon-echo decay. One of the consequences of this work is the development of circular polarized excitation in which clear separation of echo subsystems are observed. Author (GRA)

N71-28726# Chicago Univ., Ill. James Franck Inst.

EXPERIMENTAL INVESTIGATION OF THE ELECTRONIC PROPERTIES OF SOLIDS

H. Fritzsche Jan. 1971 16 p refs

(Contract AF 49(638)-1653)

(AD-720272; AFOSR-71-0327TR) Avail: NTIS CSCL 20/12

The report summarizes research results in abstract form. It contains a list of published papers. Several new methods have been developed and employed during the tenure of this contract. (1) The attenuation and velocities of circularly polarized ultrasonic shear waves in a magnetic field was measured in Al, Sn, and Sb at 4 degrees K. Doppler shifted cyclotron resonance and geometric resonance were interpreted. The symmetry breaking effect of shear stress was used in studying the a.c. modulation piezoreflectance in Cu; deformation potentials and pseudopotential parameters were determined. (2) Controlled amounts of paramagnetic impurities were added to the insulator of tunnel junctions to study zero bias tunneling anomalies associated with magnetic impurity interactions. The conditions for the occurrence of giant resistance and of conductance anomalies were elucidated. Bias dependent structure in the noise spectrum of Schottky barrier tunnel diodes was discovered. (3) Synchrotron radiation of a 240 MeV electron storage ring (Stoughton, Wisconsin) was used to measure the reflectance of 20 alkali halide and oxide crystals between 90-450K and 6 < h nu < 36 eV. (4) Electronic, photovoltaic, optical properties and electron spin resonance of amorphous semiconductors were studied. Author (GRA)

N71-28732# International Business Machines Corp., Oswego, N.Y. Federal Systems Div.

EPITAXIAL VAPOR GROWTH OF Hg(1-x)CdxJTe IN AN

OPEN TUBE APPARATUS Final Report, 15 Dec. 1969–15 Dec. 1970
D. R. Carpenter, A. T. Halpin, and P. B. Pickar Jan. 1971 62 p refs
(Contract N00019-70-C-D289)
(AD-721390; Rept-71-M46-001) Avail: NTIS CSCL 20/2

The report describes initial experiments made to evaluate optical density measurements as a means of monitoring, and later controlling, concentrations in vapor mixtures. First, closed optical cells containing single vapors were employed. The relationships between charge temperatures, resultant vapor pressures and measured optical densities of the vapors were established. These relationships were then studied under conditions prevailing in an open or free flowing system. This latter is currently used to grow epitaxy films of Hg(x)Cd(1-x)Te. Uniform crystal growth was obtained by means of a balanced-radiation technique for producing a flat temperature profile on the substrate during crystal growth. Precision lattice parameter measurements were used to obtain the value of X percent mole fraction of CdTe in each growth. Both short and long wavelength materials were grown and evaluated. Author (GRA)

N71-28735# Purdue Univ., Lafayette, Ind. Dept. of Physics.
BASIC RADIATION DAMAGE STUDIES Technical Progress Report, 15 Dec. 1969–15 Dec. 1970
30 Dec. 1970 5 p refs
(Contract AT(11-1)-125)
(COO-125-56) Avail: NTIS

The studies are being concentrated on the defects introduced into Ge and Si by electron irradiation at low temperatures, their behavior and reactions, and radiation annealing. Results reported are on radiation annealing of two acceptor centers in n-type Ge, temperature-dependent radiation annealing in n-type Si, and radiation annealing of E centers in Si. NSA

N71-28736# Pennsylvania State Univ., University Park. Materials Research Lab.
FERROELECTRICITY AND CONDUCTION IN FERROELECTRIC CRYSTALS Interim Report, 1 Mar. 1969–31 Oct. 1970
Leslie E. Cross Wright-Patterson AFB, Ohio AFAL 30 Nov. 1970 214 p refs
(Contract F33615-69-C-1446)
(AD-721479) Avail: NTIS CSCL 20/12

In the work to date on this contract, two important new advances have been made. Ferroelectric lithium thallium tartrate monohydrate has been shown to be of a new type, in which very strong piezoelectric coupling plays a major role in stabilizing the polar phase below 12 degrees K. The ferroelastic-ferroelectric-ferrimagnetic crystal nickel iodine boracite, which has cubic symmetry above 120 degrees K was shown to exhibit intrinsic optical anisotropy at room temperature. The phenomenology and structure in the bismuth oxide family of ferroelectrics are studied and the possibility of intrinsic switching of P(s) in the c-direction at very low temperatures is suggested in Bi4Ti3O12. X-ray and neutron diffraction analysis has shown that the monoclinic shear in this crystal is not more than 40 seconds of arc, and a new structure based systematization of the other layer structures is proposed. Preliminary exploratory studies have shown some evidence of ferroelectricity in Beta-spodumen, which may be the first ferroelectric silicate structure. Author (GRA)

N71-28765 Pennsylvania State Univ., University Park.
SOME STRAIN INDUCED TRANSPORT EFFECTS IN GERMANIUM
Jan Frederick Schetzina (Ph.D. Thesis) 1969 153 p
Avail: Univ. Microfilms Order No. 70-13878

A series of high stress piezoresistance and piezodrift experiments have been performed at constant temperatures between 77 K and 300 K using both p-type and n-type germanium samples. The successful completion of these experiments required the development of a precision vise, cryostat and strain detection system. The minority electron mobility was measured by performing a series of Haynes-Shockley drift mobility experiments in which both the applied stress and the electron drift path were along a [111] crystal direction. In order to correctly determine the minority carrier mobility from an experiment of this type it was necessary to generalize the ambipolar theory given by van Roosbroeck to include anisotropic transport. This generalization was accomplished under the assumption of electrical neutrality together with certain restrictions placed on the form of the carrier mobility tensors, all of which were satisfied in the present case. Dissert. Abstr.

N71-28766 Illinois Univ., Urbana.
PIEZOREFLECTANCE OF GALLIUM ARSENIDE
James Everett Wells (Ph.D. Thesis) 1969 101 p
Avail: Univ. Microfilms Order No. 70-13535

The response of the reflectivity spectrum of single crystal GaAs to uniaxial stress of the (001) and (111) directions was determined. Interband transitions were detected at 1.425 + or − .015, 1.76 + or − .02, 2.89, 3.12, and 4.5 eV. The two lowest energy transitions are shown compatible with Gamma symmetry, and the Pikus and Bir deformation potential ratio d/b approximately 3.2 is determined. Second harmonic response at 1.4 eV is shown in agreement with a rigid shift model for the strain perturbation. The 2.89 and 3.12 eV transitions exhibit modulated reflectivity lineshapes expected of Lambda symmetry. Comparison is made with the stress-modulated response of a symmetry-related transition in germanium. The deformation potential ratios have been derived. Comparison of the hydrostatic component of the perturbation with the energy derivative of the unmodulated reflectivity spectrum shows good agreement with a rigid shift model. Finally, the 4.5 eV transition has shown a response to the strain perturbation indicative of a delta symmetry. Dissert. Abstr.

N71-28771 California Inst. of Tech., Pasadena.
SUPERCONDUCTING PROXIMITY EFFECT CURRENTS IN INDIUM ABOVE ITS TRANSITION TEMPERATURE
John Burgess Trenholme (Ph.D. Thesis) 1970 119 p
Avail: Univ. Microfilms Order No. 70-12441

The superconducting proximity effect, in which superconductivity diffuses from a superconductor into an adjacent nonsuperconductor, was investigated using the SNS sandwich method in order to test the predictions of the de Gennes-Werthamer theory of temperature dependence of the Ginzburg-Landau equation. Sandwiches were made in which Pb injected superconductivity into a central layer of In, so that the maximum lossless current through the In could be found as a function of temperature down to the In transition temperature (3.4K). Techniques were used to insure uniform current flow, and to avoid annealing. The log of the critical current density of the sandwiches decreased linearly with temperature above the In transition; the current became much larger below the transition. The de Gennes-Werthamer theory was extended by the addition of the nonlinear term in the Ginzburg-Landau equation; exact solutions of the one-dimensional Ginzburg-Landau equation in the presence of current (but with A = 0) were used to find the theoretical temperature variation of the critical current density. The experimental and theoretical curves showed the same linear behavior (although there were slope and value variations), thus verifying the de Gennes-Werthamer theory near the transition temperature of a material. Dissert. Abstr.

N71-28776 Illinois Univ., Urbana.
PLASTIC DEFORMATION IN ULTRAMICROTOMY OF COPPER AND ALUMINUM
Jay Temple Black (Ph.D. Thesis) 1969 201 p
Avail: Univ. Microfilms Order No. 70-13244

Thin metal films were microtomed from high purity copper and aluminum single crystals and examined in electron microscopes in order to study the plastic deformation introduced into such chips by the microtomy process. In addition, copper and aluminum single

crystals of identical orientation to those microtomed were polished and machined at microtome cutting speeds (1 mm/sec) so that the slip line structure produced by the machining process could be examined. The tool material used throughout was glass. A technique termed deformation replication was developed to study the edge of the glass knives. A wire embedding technique was developed to facilitate the microtomy process of wire specimens. Both scanning and transmission electron microscopes were used. Microtomed thin films of copper and aluminum had a segmented appearance. Dissert. Abstr.

N71-28784 Ohio State Univ., Columbus.
ELECTRICAL CHARACTERISTICS OF THE SILICON NITRIDE-GALLIUM ARSENIDE INTERFACE
John Edwin Foster (Ph.D. Thesis) 1969 119 p
Avail: Univ. Microfilms Order No. 70-14019

The interface formed by depositing silicon nitride on p and n type gallium arsenide is investigated by the metal-insulator-semiconductor capacitance method. A hysteresis effect due to charge trapping in the silicon nitride is found to be highly dependent on the NH3 to SiH4 ratio used in the deposition. Minimum hysteresis is obtained at a deposition temperature of 700 C at a 60:1 NH3 to SiH4 ratio. The emptying of traps is very slow and logarithmic in time. Relaxation times in the 10 to the 10th power minutes range are indicated. Traps can be emptied by application of a negative bias for a few minutes or by heating the sample of 200 C and cooling slowly. The traps in the Si3N4 near the gallium arsenide interface are found to be of two types; a neutral or positive, when empty. Surface states are of the acceptor type. Flatband occurs at negative and positive voltage, respectively, for p and n type samples. Surface state densities for the best p and n samples are in the 10 to the 12th power to 10 to the 13th power range. Dissert. Abstr.

N71-28797# Baylor Univ., Waco, Tex.
CRYSTAL STRUCTURE AND MORPHOLOGY OF HYDROUS OXIDES AND HYDROXIDES IN THE LANTHANIDE AND ACTINIDE SERIES Progress Report
W. O. Milligan Feb. 1971 38 p refs
(Contract AT(40-1)-3955)
(ORO-3955-2) Avail: NTIS

Research progress is reported on: aging of lanthanide trihydroxides, lattice constants for the standard hexagonal form of lanthanide trihydroxides, preparation and characterization of a new phase of erbia, Nd(OH)3 and its structure, and morphology of actinide hydroxides. NSA

N71-28838# Illinois Univ., Urbana.
ELECTRON IRRADIATION EFFECTS IN SILICON AT LIQUID HELIUM TEMPERATURES USING AC HOPPING CONDUCTIVITY
Ronald Eugene McKeighen (Ph.D. Thesis) 1971 128 p refs
(Contract AT(11-1)-1198)
(COO-1198-781) Avail: NTIS

Changes in ac hopping conductivity with electron irradiation have been measured in n-type silicon, p-type silicon, and high-purity silicon. Irradiations were carried out at both 5.0 and 1.6 K, with measurements made at reference temperatures of 4.2 and 1.3 K, respectively. In the p-type crystals, the changes in ac hopping conductivity depended strongly on the concentration of chemical acceptors, indicating a concentration dependence on impurities in the defect production rate. The production rates at 1.6 K were generally very similar to those for a 5.0 K irradiation. No significant thermal-annealing stages below room temperature were observed in any of the crystals. A small increase in ac hopping conductivity was observed below 30 K. No radiation-annealing effects due to a beam of either 0.500 or 0.350 MeV electrons were observed, either at 4.8 K or at 1.45 K. Author (NSA)

N71-28842# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
INTERNATIONAL CONFERENCE ON THE PHYSICS OF SEMICONDUCTORS (10th) Final Report
William Paul Feb. 1971 17 p Conf. held at Cambridge, Mass., 17–21 Aug. 1970
(Grant Nonr(G)-00001-70)
(AD-722038) Avail: NTIS CSCL 20/12

The Tenth International Conference on the Physics of Semiconductors was held at the Massachusetts Institute of Technology, Cambridge, Massachusetts, from August 17 through August 21, 1970. There were over 600 participants from 27 countries. The full Organization of the Conference is given in detail in Appendix 1. The Table of Contents of the Proceedings is attached as Appendix 2 of this Report. The Proceedings itself is available as another report; designated as CONF-700801. GRA

N71-28844# Stanford Univ., Calif. Microwave Lab.
DEVELOPMENT OF CHALCOPYRITE CRYSTALS FOR NONLINEAR OPTICAL APPLICATIONS Interim Technical Report, 1 Aug. –31 Oct. 1970
S. E. Harris and R. S. Byer Oct. 1970 11 p
(Contract F33615-70-C-1640; ARPA Order 1636)
(AD-722097; SU-ML-1896; TR-1) Avail: NTIS CSCL 20/2

Research is being conducted to grow and evaluate crystals of the chalcopyrite class for use in nonlinear optical applications, modulator applications and semiconductor applications. Toward this goal attempts to grow single crystals are being made with appropriate measurements and evaluation of each crystal sample obtained. GRA

N71-28845# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SOLID STATE RESEARCH Quarterly Technical Summary Report, 1 Aug. –31 Oct. 1970
Alan L. McWhorter 9 Feb. 1971 63 p refs
(Contract F19628-70-C-0230)
(AD-721464; ESD-TR-70-350) Avail: NTIS CSCL 20/12

The report covers in detail the solid state research work of the Solid State Division at Lincoln Laboratory for the period 1 August through 31 October 1970. The topics covered are Solid State Device Research, Materials Research, Physics of Solids, and Microelectronics. The Microsound work is sponsored by ABMDA and is reported under that program. Author (GRA)

N71-28846# Stanford Univ., Calif. Microwave Lab.
DEVELOPMENT OF CHALCOPYRITE CRYSTALS FOR NONLINEAR OPTICAL APPLICATIONS Interim Technical Report, 1 Nov. 1970 –31 Jan. 1971
S. E. Harris, R. S. Byer, and V. L. Donlan Feb. 1971 27 p refs
(Contract F33615-70-C-1640; ARPA Order 1636)
(AD-722098; SU-ML-1933; ITR-2) Avail: NTIS CSCL 20/2

Considerable progress has been made in evaluating the optical constants of CdGeAs2. The birefringence and dispersion have been measured allowing phasematching data to be calculated. In addition to optical measurements, work has continued on the crystal growth problem. At the present time, a series of 30 samples are being prepared and evaluated to determine the equilibrium phase diagram for CdGeAs2. The present experiment to measure by second harmonic generation the nonlinear coefficient of CdGeAs2 is discussed. Author (GRA)

N71-28847# Los Alamos Scientific Lab., N.Mex.
ENTHALPY OF ACTIVATION OF CARBON SELF-DIFFUSION IN CUBIC CARBIDES
B. N. Oshcherin Mar. 1971 9 p refs Transl. into ENGLISH from Fiz. Metal. i Metalloved. (Moscow), v. 29, 1970 p 300–304
(LA-TR-71-13) Avail: NTIS

The activation enthalpy of self-diffusion in crystals with an NaCl structure and the activation enthalpy of carbon self-diffusion in cubic carbides are considered on the basis of the concept that the activation enthalpy of diffusion is against the forces causing the lattice strength, in the case of a vacancy diffusion mechanism.
Author (NSA)

N71-28871 California Univ., Los Angeles.
INSTRUMENTATION FOR THE MEASUREMENT OF FAST ELECTRIC FIELDS USING THE ELECTROOPTIC EFFECT IN CRYSTAL
Richard Oliver Hargrove (Ph.D. Thesis) 1969 177 p
Avail: Univ. Microfilms Order No. 70-14286

A system engineering study for the instrumentation required to determine quantitative waveforms of individual radar pulses is described. This measurement capability is desired to provide a means for the evaluation of nanosecond radar transmitters and associated hardware. The capabilities needed are sensitivity of 1000 volts per centimeter, risetime of 10 picoseconds, precision time measurement within RF pulse for times up to 20 nanoseconds and from pulse to pulse for times up to one second, as well as trigger to event and event to event capability with both internal and external synchronization. All measurements are required to be performed on a one-shot nonrepetitive basis with the output data available in one minute or less. Three possible solutions to the instrumentation problem are presented. The crystal field sensing probe is regarded as the most crucial element in the system.
Dissert. Abstr.

N71-28988 Wisconsin Univ., Madison.
SPIN-LATTICE RELAXATION AND ATOMIC MOTIONS IN LiF
Jerome Wagner (Ph.D. Thesis) 1970 88 p
Avail: Univ. Microfilms Order No. 70-11866

Spin-lattice relaxation times of the Li-7 spins in LiF were investigated using pulsed NMR techniques to determine the dominant mechanisms contributing to the normal high field relaxation at laboratory fields of several kilogauss and also those contributing to the rotating frame relaxation corresponding to effectively low fields obtained by keeping the spins saturated. The experiments exhibit the very long intrinsic T1 of LiF enabling achievement of exceptional sensitivity to very dilute and very long correlation time interactions with defects and impurities and the study of these interactions in the relatively low temperature region 400 deg. K. The most outstanding relaxation phenomena is due to the motion of vacancies bound to divalent impurities. A strong collision theory is developed to explain rotating frame quadrupolar relaxation in several different regimes of vacancy jump times. The dominant relaxation mechanism from nitrogen temperature to room temperature in both the laboratory frame and rotating frame measurements appears to be the interactions of both the Li and F spins with fast relaxing paramagnetic centers whose concentrations are only a few ppm.
Dissert. Abstr.

N71-28989 Iowa State Univ., Iowa City.
TEMPERATURE EFFECTS ON GROWTH AND NUCLEATION RATES IN MIXED SUSPENSION CRYSTALLIZATION
Wayne John Genck (Ph.D. Thesis) 1969 115 p
Avail: Univ. Microfilms Order No. 70-13585

A laboratory continuous, mixed suspension, mixed product removal, cooling crystallizer was constructed and operated to study the effect of temperature of crystallization on the kinetics of nucleation and crystal growth while maintaining the constraint of constant suspension density. Analysis technique based on the concept of the population balance was employed to obtain the kinetic rates at various operating temperatures for three inorganic potassium salts. Nucleation and growth rates were found to be dependent on the temperature of crystallation. The supersaturation level supported, being related to the combined kinetics of nucleation and growth at a particular temperature, was found to vary with the crystallization temperature when operating at the same production rate. The variance in the supersaturation level was employed to explain the resulting kinetics at the different operating temperatures.
Dissert. Abstr.

N71-28990 North Carolina Univ., Chapel Hill.
SUPERCONDUCTING TUNNELING IN SINGLE CRYSTAL AND POLYCRYSTAL THIN FILMS OF ALUMINUM
Gene Landis Wells (Ph.D. Thesis) 1969 74 p
Avail: Univ. Microfilms Order No. 70-12120

A semi-classical theory of electron tunneling is developed. It is shown that superconducting tunneling measurements can be interpreted in terms of an energy gap which is effective in an 11-1/2 deg con about the normal to the tunnel junction. Comparison of the measured energy gap and transition temperature for thin films of aluminum with bulk values is discussed. Measurements of the energy gap and transition temperature of aluminum films in six different types of tunnel junctions are reported. It was found that the transition temperature of aluminum films was linearly dependent upon the strain caused by thermal expansion differences between the aluminum film and the substrate. The energy gap measured in the [100] and [111] directions in single crystal aluminum films was consistent with previous measurements on bulk single crystal aluminum.
Dissert. Abstr.

N71-29014# National Bureau of Standards, Washington, D.C. Inorganic Materials Div.
ARPA-NBS PROGRAM OF RESEARCH ON HIGH TEMPERATURE MATERIALS AND LASER MATERIALS
Progress Report, 1 Jul. –31 Dec. 1970
A. D. Franklin and H. S. Bennett, eds. May 1971 46 p refs
(ARPA Order 373-62)
(NBS-TN-574) Avail: SOD $0.50

Progress reports are given for projects on the growth of ultra-pure Al2O3 crystals; the development of a mass spectrometer-based sectioning technique for measuring oxygen diffusion in oxides; the development of a precision facility for measuring the threshold energy in a laser beam producing damage in a transparent substance; and the study of the factors influencing this damage threshold in glass.
Author

N71-29015 Utah Univ., Salt Lake City.
A SMALL SIGNAL FIELD ANALYSIS OF DOUBLE-STREAM INTERACTIONS IN FINITE SEMICONDUCTORS
Lewis Charles Goodrich (Ph.D. Thesis) 1970 262 p
Avail: Univ. Microfilms Order No. 70-14441

The possibility of using double-stream interactions between the counterstreaming electrons and holes in a solid state plasma to build a high frequency microwave oscillator is investigated both theoretically and experimentally. A general mathematical analysis which includes collision and Landau damping effects is developed. A general dispersion equation is derived which includes not only space-charge waves and cyclotron waves, but fast waves as well. An investigation of the finite dispersion equation shows that the solutions corresponding the space-charge space-charge interaction agree with solutions obtained from the one-dimensional dispersion equation. It is also found that the cyclotron space-charge interaction has negligible growth rate when compared to the growth rate obtained from the space-charge space-charge interaction. Thus, the space-charge space-charge interaction is the dominant interaction mechanism. In addition, the applied magnetic field is not essential to the interaction process, but may be necessary to aid in coupling energy out of the sample. When all factors are considered, it is concluded that it is extremely unlikely that double-stream interaction in solids will ever result in a very practical signal source.
Dissert. Abstr.

N71-29042# Illinois Inst. of Tech., Chicago. Dept. of Physics.
THERMAL MEASUREMENTS ON SOLIDS BELOW 1 K Progress Report
Harold Weinstock Feb. 1971 21 p refs
(Contract AT(11-1)-1629)
(COO-1629-24) Avail: NTIS

Results of a number of low temperature measurements on solid compounds are reported. The U-H center interaction at 4.2 to 77 deg K in doped alkali halides was investigated by an ultraviolet-infrared study. Pyrolytic effects of a magnetic field on the thermal conductivity of graphite were determined at 0.36 to 4.2 deg K. Fast neutron studies of radiation effects on low temperature thermal conductivity of magnesium oxide single crystals were also conducted. Author (NSA)

N71-29156* Radio Corp. of America, Princeton, N.J.
METHOD OF CHANGING THE CONDUCTIVITY OF VAPOR DEPOSITED GALLIUM ARSENIDE BY THE INTRODUCTION OF WATER INTO THE VAPOR DEPOSITION ATMOSPHERE Patent
Sidney G. Ellis, inventor (to NASA) Issued 13 Aug. 1968 4 p Filed 25 Mar. 1965 Cl. 148-174 Sponsored by NASA
(NASA-Case-XNP-01961; US-Patent-3,397,094;
US-Patent-Appl-SN-442835) Avail: US Patent Office CSCL 20L

A continuous method of forming a junction by chemical transport is disclosed by vaporizing a semiconductor source compound such as gallium arsenide and an impurity such as zinc. The gallium is transported to a heated substrate as a vaporous chemical transport compound in a carrier gas such as hydrogen by reaction with a chemical reagent such as water to form a gallium oxide. The gallium oxide combines with arsenic at the substrate surface to form a zinc doped epitaxial layer of gallium arsenide of first type of conductivity. A second layer of different conductivity is epitaxially grown to form a junction by changing the temperature of the substrate or by changing the water content of the carrier gas to a selected level. Official Gazette of the U.S. Patent Office

N71-29157# Iowa State Univ. of Science and Technology, Ames.
PREPARATION OF LANTHANIDE SINGLE CRYSTALS, PART 1. ELASTIC MODULI AND THERMAL EXPANSION OF LUTETIUM SINGLE CRYSTALS FROM 4.2 TO 300 K, PART 2
James John Tonnies Nov. 1970 79 p refs
(Contract W-7405-eng-82)
(IS-T-408) Avail: NTIS

A study was made on three methods that could be used in preparing large single crystals of the light lanthanide metals, praseodymium and neodymium, and the heavy lanthanide metal, lutetium. The strain–anneal process with its variations was successfully applied in preparing lutetium crystals. The electron beam floating zone technique and the crystallographic transformation method showed the greatest promise for praseodymium and neodymium. The adiabatic elastic moduli and linear thermal expansion coefficients of lutetium single crystals were calculated for 4.2 to 300 K from sound wave transit times and density values. Author (NSA)

N71-29158 National Lending Library for Science and Technology, Boston Spa (England).
PHENOMENA OF MIXED IONIC AND ELECTRONIC CONDUCTIVITY IN SOLIDS
Y. L. Olshanskii 3 Nov. 1970 18 p refs Transl. into ENGLISH from Vopr. Petrogr. i Mineralog., Akad. Nauk SSR (Moscow), no. 2, 1953 p 211–219 In ENGLISH and RUSSIAN
(NLL-LTI-746-617-(9022.401); LTI-734-5505) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The occurrence of mixed ionic and electronic conductivity in solids at various temperatures is discussed. All electronic semiconductors, having an ionic crystal lattice, must possess some ionic conductivity. At low temperatures, the amount of ionic conductivity is insignificant. Ionic conductivity becomes important at temperatures as low as 200 to 600 degrees C and the temperatures at which ionic conductivity becomes important for various semiconductor materials are investigated. P.N.F.

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N71-28242# National Defense Research Organization TNO, Rijswijk (Netherlands). Technological Lab.
SELF-IGNITION HAZARD OF NITRATE ESTER PROPELLANTS
Johannes Leonardus Cornelis Van Geel (Ph.D. Thesis) Feb. 1969 105 p refs
Avail: NTIS

The heat generation of nitrate ester propellants is investigated in order to obtain quantitative information on the self-heating process during storage. Particular attention is given to the kinetics and heat effects of degradation, the physical properties of the propellants, and the storage conditions. ESRO

N71-28362* General Dynamics Corp., San Diego, Calif. Convair Aerospace Div.
STUDY OF LOW GRAVITY PROPELLANT TRANSFER Quarterly Progress Report, 23 Dec. 1970–30 Apr. 1971
J. A. Stark, E. H. Bock, and J. R. Elliott 10 May 1971 75 p refs
(Contract NAS8-26236)
(NASA-CR-119831; GDC-584-4-639; QPR-3) Avail: NTIS CSCL 21I

Hardware design was essentially completed on the bellows, metallic diaphragm, and paddle vortex subcritical transfer systems. A number of different bellows system configurations were considered, each to contain a liquid volume of 42.5 cu ft. The minimum weight system was determined to consists of a bellows with an L/D ratio of 1.5, and overall system parametric weight data were generated over a range of spherical tank diameters of 25 to 150 inches and expulsion pressures of 50 to 500 psia. It was determined that hardware weights and power requirements of the paddle vortex system were competitive with other systems at the 42.5 cu ft tank volume. The receiver tank chilldown program was modified to cover pressures from 1 to 1000 psia and, for H2 densities, from 0.00033 to 4.55 lb/cu ft. Initial runs indicated that the line chilldown mostly occurred over a small fraction of the total transfer time. Chilldown analysis indicates that only at maximum line lengths and minimum inlet pressures is the line chilldown likely to become a significant factor, and that maximum pressure in a locked-up tank is a strong function of heat transfer rate. High pressure transfer systems were considered and transfer of supercritical fluid by heating the supply fluid shows the most promise. Author

N71-28560# Louvain Univ. (Belgium). Inorganic Chemistry Lab.
EXPERIMENTAL AND THEORETICAL STUDY OF CHEMILUMINESCENCE IN FLAMES AND OF COMBUSTION IN SOLID PROPELLANTS Final Report
Pierre J. Van Tiggelen Dec. 1970 74 p refs
(Contract F61052-70-C-0016)
(AD-720283; AFOSR-TR-71-0128) Avail: NTIS CSCL 21/2

The two parts of the report deal successively with chemiluminescence in flames and with combustion of solid propellants. Relationships between chemiluminiscence (CL) and chemi-ionization (CI) on one hand, and the molecular structure of

the fuel on the other hand have been put forward, in particular the strucure of hydrocarbon fuels have been investigated. Applying the multimicrojet burner technique for the simulating study of heat transfer from the reaction zone onto the regressing surface of solid propellants, it has been possible to investigate the dependence of the heat release on parameters such as total flow, distribution modes of gases, dilution and richness of flammable mixture and to correlate the heat release as a function of the burning velocity alone. Moreover, a new reliable technique to prepare cigarettes of (polymthyl methacrylate) for hydrid combustion has been developed where one can get rid of any trace of acetone, and where heat losses to the wall of the tube are avoided during the burning process. Mass burning rates of PMM with N2O and O2 have been recorded, and the porosity of the sample has been studied. Author (GRA)

N71-28576# Air Force Systems Command, Wright-Patterson AFB, Ohio. Aero Propulsion Lab.

INFLUENCE OF FUEL SLOSH UPON THE EFFECTIVENESS OF NITROGEN INERTING FOR AIRCRAFT FUEL TANKS Technical Report, 1 Apr. – 3 Jun. 1970

Edwin E. Ott and Robert A. Lillie Feb. 1971 34 p refs

(AD-721675; AFAPL-TR-70-82) Avail: NTIS CSCL 21/4

Tests were conducted to determine the influence of sloshing fuel within an aircraft fuel tank upon the effectiveness of nitrogen inerting. These tests were performed in a closed combustion chamber partially filled with JP-8 fuel. The fuel was severely agitated by a rocking motion of the chamber. The flammability of the tank ullage at various concentrations of air, nitrogen, and fuel vapor was tested by exposure to an electric arc. The sloshing fuel did not alter the maximum concentration of oxygen that could be allowed for inerting of all fuel vapor concentrations. For JP-8 fuel vapor exposed to an electric arc this maximum allowable oxygen concentration was found to be 12% by volume. Slosh did extend the flammable region for oxygen concentrations greater than the maximum allowable for inerting. These conclusions, it is believed, are valid for any mode or level of fuel agitation that may be experienced by aircraft fuel tanks. Author (GRA)

N71-28577# Army Mobility Equipment Research and Development Center, Fort Belvoir, Va.

EFFECTS OF CORROSION AND ANTI-ICING INHIBITORS ON THE WATER COALESCING CHARACTERISTICS OF MILITARY STANDARD FILTER/COALESCER ELEMENTS Final Report

Shirley B. Boulware Feb. 1971 40 p

(AD-722231; USAMERDC-1998) Avail: NTIS CSCL 21/4

The report covers a study of the effects of seven corrosion inhibitors and corrosion/anti-icing inhibitor combinations on the coalescing characteristics of the DOD-type filter coalescer elements used to decontaminate liquid hydrocarbon fuels. The corrosion inhibitors are specified for use in military jet fuels. The report concludes that: The corrosion and corrosion/anti-icing combination inhibitors did not produce adverse effects on the ability of military standard filter/coalescer elements to remove 1-percent water from JP-5 fuel that had been treated with fullers earth. The free-water content of the fuel passed through the filter/coalester elements during the 1-percent water injection tests ranged from 0 to 4.4 ppm, which is within specification limits. The WSIMs of the inhibited JP-5 fuel during the tests were between 16 and 88. The low, free-water content did not correlate directly with the relatively low WSIMs. The WSIM cannot be used solely to determine the ability of a military standard filter/coalescer element to decontaminate inhibited JP-5 after it has been treated with fullers earth. However, the WSIM does give an indication of the ability of a filter/coalescer element to decontaminate uninhibited JP-5. Author (GRA)

N71-28784# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Traven (West Germany).

COMBUSTION MECHANISM OF COMPOSITE PROPELLANTS DURING DEPRESSURIZATION Progress Report, 1 Jul. – 31 Dec. 1970

J. A. Steinz and H. Selzer 31 Jan. 1971 30 p refs

(Contract F61052-70-C-0013)

(AD-722084; AFOSR-71-0931TR; PR-2) Avail: NTIS CSCL 21/9

Apparatus required to investigate the depressurization extinguishment behavior of solid propellants was constructed and a series of tests was conducted using a number of AP propellant compositions at several pressure levels. The results define more clearly the effects of these parameters on the dynamic behavior of the flame. A summary of the findings plus a detailed description of the apparatus and procedures used is given in the report. Author (GRA)

N71-28929* North American Aviation, Inc., El Segundo, Calif.

PROPELLENT TANK PRESSURIZATION SYSTEM Patent

Marshall A. Appel and Donald F. Weitzel, inventors (to NASA) 23 Feb. 1965 4 p Filed 19 Apr. 1963 Cl. 60-39.48 Sponsored by NASA

(NASA-Case-XNP-00650; US-Patent-3,170,295; US-Patent-Appl-SN-271823) Avail: US Patent Office CSCL 21I

Hot combustion products and vaporized oxidizer are used to individually pressurize the propellant tanks. The combustion products pressurize the fuel tank, and the vaporized oxidizer pressurizes the oxidizer tank. Fuel and oxidizer are obtained from the propellant tanks and are combined in a fuel rich mixture. They are then combusted to completely consume the oxidizer and form hot combustion products. The hot combustion products are then fed to a heat exchanger. Additional oxidizer is then bled from the oxidizer propellent tank and passed through the heat exchanger where it is vaporized by the hot combustion products. The oxidizer in turn, cools the hot combustion products to a temperature that is compatible with the fuel to be pressurized. The vaporized oxidizer is then fed back to the oxidizer propellant tank to pressurize it. And, the combustion products are fed to the fuel propellant tank to pressurize this tank. Official Gazette of the U.S. Patent Office

N71-29088*# Battelle Memorial Inst., Columbus, Ohio.

RADIATION EFFECTS ON LIQUID PROPELLANTS, PART 2 Final Report

J. F. Kircher and D. A. Vaughan 22 Jan. 1971 31 p ref Prepared for JPL

(Contract NAS7-722)

(NASA-CR-109767-Pt-2) Avail: NTIS CSCL 21I

The effects of radiation on the stability and compatibility of hydrazine (N2H4) and hydrazine-24% hydrazine nitrate (N2H4-24N2H5NO3) in four commercial-alloy container materials (1100A1, 6061A1 T-6, 347 stainless steel, and Ti-6A14V) were investigated. Radiolytic decomposition of the propellants gave G-values of about 4.5 and 7.8 for N2H4 and N2H4-24N2H5NO3, respectively, although it varied somewhat with container material and radiation dose. The N2H4 was found to be compatible with all four alloys, whereas the N2H4-24N2H5NO3 reacted with all the materials, but reacted most with 347 SS. Although the magnitude of the reaction does not alter appreciably the surface structure of the capsule or of coupon test specimens, it is sufficient to contaminate the propellant and cause discoloration, and might clog the 347 SS capillary tubing of the feed system of a liquid propulsion system. A filter unit designed for fuel cleaning operated without plugging or visible attack by either propellant, but the ethylene-propylene O-ring seal showed evidence by crosslinking when irradiated under load. Author

N71-29155* TRW Systems Group, Redondo Beach, Calif.

BOOSTER TANK SYSTEM Patent

Charles N. Tripp, inventor (to NASA) Issued 22 Nov. 1966 6 p Filed 18 Oct. 1962 Cl. 222-61 Sponsored by NASA

(NASA-Case-MSC-12390; US-Patent-3,286,882; US-Patent-Appl-SN-231520) Avail: US Patent Office CSCL 21I

An internal propellant tank pressurization system is described that is controlled by simple pressure sensitive on-off control switches to regulate the pressure exerted on the propellant and that provides a pressure medium which does not require large and heavy storage chambers. A two-phase fluid is utilized to exert pressure on the propellant within the propellant tank.

Official Gazette of the U.S. Patent Office

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magneto-hydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N71-28041*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

COMPARISON OF SIMPLEX AND DUAL-ORIFICE FUEL NOZZLES WITH AMBIENT AND HEATED FUEL IN AN ANNULAR TURBOJET COMBUSTOR

Donald F. Schultz, Jerrold D. Wear, and Porter J. Perkins Washington Jun. 1971 36 p refs

(NASA-TN-D-6355; E-5999) Avail: NTIS CSCL 21E

A full scale annular combustor was operated with simplex fuel nozzles of three flow ranges and with dual orifice fuel nozzles. The dual orifice nozzles provided combustion efficiencies within 2 to 3 percent of the peak values obtained with any of the simplex atomizers. A wide range of operating conditions including altitude relight, simulated takeoff, Mach 2.7 cruise, and Mach 3.0 cruise were studied. Measurements were made of combustion efficiency, pattern factor, flame radiation, smoke emission, and response to rapid increase in fuel flow. Fuel heated to 300 F (423 K) was used in many of the tests; heated fuel usually increased combustion efficiency. Author

N71-28128*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

FEASIBILITY STUDY OF JET-FUEL-COOLED PLUG NOZZLE FOR AFTERBURNING TURBOJET

Francis S. Stepka and Rene E. Chambellan Washington Jun. 1971 36 p refs

(NASA-TM-X-2304; E-6022) Avail: NTIS CSCL 21E

A conceptual design for a fuel-cooled plug nozzle is presented. Factors affecting cooling, fuel coking, construction, and strength were considered. Results indicate that the total available engine fuel flow was sufficient to restrict the maximum temperature of the metal contacting fuel to 817 K (1010 F) or less. Even at this maximum temperature, coking of cooling tubes is not expected to be significant for at least 100 hours of engine operation, based on experimental results of others with low-oxygen-content jet fuel flowing in heated tubes. Author

N71-28188*# Aerojet-General Corp., Sacramento, Calif.

ADVANCED INJECTOR CONCEPTS INVESTIGATION Final Report

30 Apr. 1971 193 p refs

(Contract NAS8-21052)

(NASA-CR-119796; FR-21052-3F) Avail: NTIS CSCL 21H

The feasibility of trapping turbine drive gases from combustion chambers and passing them through a HIPERTHIN (throttling injector design) injector counter to the flow of incoming propellants was analyzed to determine whether or not the hot gases could transfer enough heat to vaporize the incoming propellants. It was concluded that the hot gas tapoff cycle injector is feasible over the full throttling range specified, using nickel as the injector material. The annular segment injector was engine tested to obtain combustion stability, injector face cooling, and steady state performance data at chamber pressures up to 2500 psia. J.M.

N71-28316*# Pratt and Whitney Aircraft, East Hartford, Conn.

HIGH-LOADING LOW-SPEED FAN STUDY. 3: DATA AND PERFORMANCE SLOTTED BLADES AND VANES AND ROTOR TIP TREATMENT

K. G. Harley, J. Harris, and E. A. Burdsall Jul. 1971 281 p refs

(Contract NAS3-10483)

(NASA-CR-72895; PWA-3899) Avail: NTIS CSCL 20E

A single-stage fan with a tip speed of 1000 ft/sec, a pressure ratio of 1.5 and a hub to tip ratio of 0.392 was tested from 85 to 110% of design speed to determine the effect of various design features on performance, stall characteristics, and noise. The tests were conducted with both uniform and radially distorted inlet flow. Stator-hub slit suction was used to improve the stator performance. The rotor and stator slots improved both the pressure rise and the efficiency of part speed. With stator hub (and tip) slots, the stall flow was repeatable and agreed with the minimum value obtained without slots. Rotor tip treatments were applied mainly during tip radially distorted inlet flow tests where the rotor tip rather than the stator hub caused the stage to stall. Use of a honeycomb structure in the case over the rotor tips in combination with vortex generators improved the stall margin by as much as ten percentage points but caused about a seven-point reduction in overall efficiency. The addition of the honeycomb over the rotor blade tips increased the blade passing frequency noise levels 5 to 10 dB. For Vol. 2, see N70-27228. Author

N71-28579# Purdue Univ., Lafayette, Ind. Jet Propulsion Center.

STUDIES OF SLURRY FUELED PROPULSION SYSTEMS Semiannual Progress Report

Cecil F. Warner and H. Lawrence Dyer Feb. 1971 30 p refs

(Contract N00014-67-A-0226-0013)

(AD-721685; TM-71-4; SAPR-2) Avail: NTIS CSCL 21/4

A one-dimensional equilibrium thermochemistry program, originally written for air-augmented rockets, was modified to accommodate calculations for a boron slurry fuel. The program was used for the prediction of combustion temperature, product species, and air specific impulse values as a function of total equivalence ratio. The results of the modified program are shown to be in good agreement with similar results from two other equilibrium programs. Subsequent calculations were made to obtain design parameters for an experimental facility to investigate the combustion phenomena of a boron slurry fuel. Cold flow experimental tests were conducted to evaluate potential slurry injector designs. An air atomizer injector was designed that produced good initial dispersion of the slurry fuel, at a desirable flow rate, and for an acceptable pressure drop across the injector. An approach to the design of combustor cans for burning slurry fuel is presented. Author (GRA)

N71-28817*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

POTENTIAL STAR TRACKER INTERFERENCE FROM RADIATION PRODUCED BY MERCURY BOMBARDMENT THRUSTERS

Nelson L. Milder [1971] 12 p refs

(NASA-TM-X-67858; E-6371) Avail: NTIS CSCL 21C

Spectrographic measurements of the radiation spectrum produced downstream of an operating 30-centimeter mercury bombardment thruster were obtained. Such measurements suggest a possible source of interference for the star tracker guidance system in spacecraft using electric propulsion systems if the tracker viewing axis intersects the thruster downstream exhaust region within two or three meters of the thruster. For distances greater

than three meters, no radiation was observed in the wavelength range corresponding to star tracker photodetector sensitivity. Author

N71-28849* North American Aviation, Inc., El Segundo, Calif.
PURGE DEVICE FOR THRUST ENGINES Patent
Vincent M. Partsch, inventor (to NASA) Issued 9 May 1967 6 p Filed 19 Jan. 1966 Cl. 60-258 Sponsored by NASA
(NASA-Case-XMS-04826; US-Patent-3,318,096; US-Patent-Appl-SN-521755) Avail: US Patent Office CSCL 21H

The back purge device is designed to be mounted and locked onto a thrust chamber in a position where the purging fluid is delivered directly into the injector splash region of the thrust chamber where a purging operation may be accomplished without interference by contaminants in the thrust chamber. The device comprises a tubular mandrel and a stainless steel actuator tube which are insertable lengthwise into a thrust chamber. The tubular mandrel is provided at one end with an expansible seal means. At its other end, the mandrel is equipped with a fitting to which a source of high pressure purging fluid may be attached. For a purging operation the device is inserted into the thrust chamber until the expansible seal means end of the device bottoms against the injector face. Official Gazette of the U.S. Patent Office

N71-28850* Hughes Aircraft Co., Culver City, Calif.
HIGH EFFICIENCY IONIZER ASSEMBLY Patent
Hayden E. Gallagher, inventor (to NASA) Issued 27 Jun. 1967 4 p Filed 4 Jun. 1964 Cl. 313-230 Sponsored by NASA
(NASA-Case-XNP-01954; US-Patent-3,328,624; US-Patent-Appl-SN-372730) Avail: US Patent Office CSCL 21C

An improved low mass ionizing device for use in an electric thrust engine is described. The use of such a device results in an increased engine efficiency and makes it feasible to use such engines in application where intermittent operation is required. The engine includes an ion source called an ionizer, a series of electrodes which accelerate and focus the ions generated by the ionizer, and a neutralizing device for neutralizing the beam of ions developed by the engine. The ionizer is composed of a porous tungsten plug or strip which is heated to a temperature in the range of 1100 C to 1300 C for operation.
Official Gazette of the U.S. Patent Office

N71-28873*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ION THRUSTER MAGNETIC FIELD CONTROL Patent Application
B. A. Banks, inventor (to NASA) 8 p Filed 28 Aug. 1970
(NASA-Case-LEW-10835-1; US-Patent-Appl-SN-67815) Avail: NTIS CSCL 21C

Instrumentation is described which provides improved starting and enables adjacent magnetic field sensing devices to properly sense the natural magentic field. The temperature controlled magnetic shunting system is self-controlled and operates without power. The magnetic field in the discharge chamber of an ion thruster is turned on and off without any external control equipment. Also, the magnetic field control does not require any external power. When the thruster is not operating the magnetic field is confined to a very small region which eliminates stray field lines which might interfere with the natural magnetic field found by adjacent magnetic field sensors. NSA

N71-28915* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
GAS TURBINE COMBUSTOR Patent
Carl T. Norgren, William H. Roudebush, and Francis M. Humenik, inventors (to NASA) Issued 1 Jun. 1971 6 p Filed 8 Jul. 1969 Cl. 60-39.36; Cl. 60-39.65; Cl. 431-352; Int. Cl. F02c3/06
(NASA-Case-LEW-10286-1; US-Patent-3,581,492; US-Patent-Appl-SN-839994) Avail: US Patent Office CSCL 21E

A method is described for maintaining good performance in a gas turbine during periods of air flow distortion by placing a diffuser duct between the liner forming the combustor and the housing surrounding the liner. Entry ports in the combustor liner have scoops which extend the full height of the diffuser duct to maintain the proper airflow distribution.
Official Gazette of the U.S. Patent Office

N71-28928* Rocketdyne, Canoga Park, Calif.
LOCKING DEVICE FOR TURBINE ROTOR BLADES Patent
Joseph A. Goodrich and Kenneth T. Ingham, inventors (to NASA) Issued 24 Aug. 1965 5 p Filed 5 Nov. 1962 Cl. 253-77 Sponsored by NASA
(NASA-Case-XNP-00816; US-Patent-3,202,398; US-Patent-Appl-SN-235588) Avail: US Patent Office CSCL 21E

A locking device or key which will hold a pair of turbine rotor blades on a turbine wheel is described. The device is designed so that it can be manufactured by easy mass production from noncritical materials and at low costs. The device is also designed to provide balance to the wheel. E.H.W.

N71-28946*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INLET-ENGINE-NOZZLE WIND TUNNEL TEST TECHNIQUES
D. N. Bowditch 1971 29 p refs Proposed for presentation at 38th Meeting of the Propulsion and Energetics Panel of the Advisory Group for Aero Res. and Develop., Sandeford, Norway, 13–17 Sep. 1971
(NASA-TM-X-67870; E-6416) Avail: NTIS CSCL 21E

Experimental investigations of the inlet, engine and exhaust nozzle of a supersonic propulsion system have been made. Exhaust nozzle results are presented which compare wind tunnel and flight results and assess the accuracy of flight measurements. Comparisons are also presented for nozzle performance obtained with a cold jet, a powered turbojet simulator, and a solid jet boundary simulator. The effect of the local boundary layer on nozzle performance is also discussed. The need for good dynamic measurements during inlet engine testing is illustrated for transients such as inlet unstart and engine stall. Also, the transient nature of inlet distortion and its effect on the engine is presented for two different operating conditions. Author

N71-28947*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PROPULSION SYSTEMS TRENDS
James F. Dugan, Jr. 17 Jul. 1971 34 p refs Presented at a Systems Oriented Workshop on US Air Transportation, Tullahoma, Tenn., 20 Jun.–17 Jul. 1971; Sponsored by Tenn. Univ. Space Inst.
(NASA-TM-X-67871; E-6420) Avail: NTIS CSCL 21E

Propulsion systems as they exist today and some trends that are anticipated for aircraft that might be flying in the 1980's are presented. The number one trend for commercial engines is to quiet them to a level no louder than the normal background noise level of the environment in which they will operate. In military engines that are not so severely noise constrained, the possibility of stoichiometric gas turbine engines is within reach and will probably come into being whenever a military requirement provides sufficient motivation to develop such an engine. Very high bypass ratio engines are likely to find application in V/STOL aircraft while the evolution of variable geometry inlets and exhaust nozzles receives its impetus from supersonic airplanes. Both supersonic and V/STOL aircraft are prime candidates for digital computer control systems that will integrate the control of the propulsion system, the airplane, and its flight path. Author

N71-29011*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

OPTIMIZATION OF ENGINES FOR A MACH 0.98 TRANSPORT WITH LOW TAKEOFF AND APPROACH NOISE LEVELS

Gerald A. Kraft and John B. Whitlow, Jr. Jun. 1971 57 p refs
(NASA-TM-X-67865; E-6407) Avail: NTIS CSCL 21E

A parametric engine study was made for a Mach 0.98 advanced technology transport using the supercritical wing. A 1978 year of first flight was assumed for the 300 passenger airplane which had a takeoff gross weight of 386,000 pounds. The engine that gave the greatest range generated too much noise. When noise constraints were used, the best fan pressure ratio was as high as duct jet noise would allow. A noise goal of 106 PNdB could be met with a 500 nautical mile range penalty using 7 PNdB machinery noise suppression. A noise goal of 86 PNdB could be met at a range penalty of 650 miles if 40 PNdB of machinery noise suppression is available. This penalty could be reduced if a light weight jet noise suppressor was used. Author

N71-29163* United Aircraft Corp., East Hartford, Conn.
TERTIARY FLOW INJECTION THRUST VECTORING SYSTEM Patent

Charles Edward Kepler, inventor (to NASA) Issued 19 Oct. 1965 7 p Filed 19 Nov. 1962 Cl. 60-35.54 Sponsored by NASA
(NASA-Case-MFS-20831; US-Patent-3,212,259; US-Patent-Appl-SN-238421) Avail: US Patent Office CSCL 21H

Added to a secondary fluid injection thrust vectoring system is the novel feature of distorting the boundary layer of the primary flow of a propulsive nozzle at a station upstream of the main secondary injection port, by injecting a small amount of fluid, called tertiary fluid or tertiary flow, into the boundary layer of the primary flow stream. This tertiary injection system results in a significant increase in lateral thrust in any injection thrust vectoring system. Official Gazette of the U.S. Patent Office

N71-29164* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TURBO-MACHINE BLADE VIBRATION DAMPER Patent

Morgan P. Hanson, inventor (to NASA) Issued 22 Aug. 1961 2 p Filed 13 Apr. 1953 Cl. 253-77
(NASA-Case-XLF-00155; US-Patent-2,997,274; US-Patent-Appl-SN-348600) Avail: US Patent Office CSCL 21E

Turbomachine blade vibration damping devices are considered for the reduction of vibration amplitude by providing one or more pins that fit into openings in the machine rotor and contact and bear against the blade shanks or appendages fixed thereto, with a continuous centrifugal force. In the event of incipient blade vibration, the bending of the blade produces relative motion between the blade shank (or appendage) and the pin or pins and the rotor. The combined effect produces frictional forces tending to dampen any destructive vibration. Official Gazette of the U.S. Patent Office

N71-29187*# General Electric Co., Cincinnati, Ohio. Advanced Technology Programs Dept.
EXPERIMENTAL QUIET ENGINE PROGRAM. VOLUME 1. PHASE 1: ENGINE DESIGN REPORT

15 Mar. 1970 386 p refs
(Contract NAS3-12430)
(NASA-CR-72967) Avail: NTIS CSCL 21E

The design of three full-scale fans, each containing low noise features are presented with bypass fan engine designs. The relative merits of low-loading versus low-speed fan designs are discussed including the effects of fan blade numbers and rotational speed on its harmonics. Materials selected for the fan designs and low pressure turbines are outlined along with the methods of stress and vibration analysis. J.M.

N71-29188*# General Electric Co., Cincinnati, Ohio. Advanced Technology Programs Dept.
EXPERIMENTAL QUIET ENGINE PROGRAM. VOLUME 2. PHASE 1: ENGINE DESIGN REPORT

15 Mar. 1970 305 p refs
(Contract NAS3-12430)
(NASA-CR-72967) Avail: NTIS CSCL 21E

Low pressure turbine rotor, stator, frame, and exhaust nozzle designs are presented for low noise turbofan engines. Thermal and mechanical stress analyses and turbine thrust balance and parasitic flow analyses are summarized. Quiet engine bearings, seals, controls and accessories, and configuration designs are included. Installation aerodynamics and performance are detailed as well as model and full-scale acoustic and engine tests and instrumentation. J.M.

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N71-28024*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
LUNAR FOSSIL MAGNETISM AND PERTURBATIONS OF THE SOLAR WIND

C. P. Sonett and J. D. Mihalov Jun. 1971 40 p refs
(NASA-TM-X-62026) Avail: NTIS CSCL 03B

Perturbations of the solar wind downstream of the moon and lying outside of the rarefaction wave which defines the diamagnetic cavity are used to define possible source regions comprised of intrinsically magnetized areas of the moon. A map of the moon is constructed showing that a model where the sources are exposed to the grazing solar wind during the lunation yields a selenographically invariant set of regions strongly favoring the lunar highlands over the maria. An alternative model with the source due to electromagnetic induction is explored. The ages of the field sources should be consistent with those based upon the basalt ages, and possibly far older if the sources are connected with the formation of the highland rocks themselves. The perturbations are tentatively identified as weak shock waves, and a Mach angle in accord with nominal values for the solar wind is found. Author

N71-28080*# Massachusetts Inst. of Tech., Cambridge. Center for Space Research
THE 'EQUILIBRIUM' ANISOTROPY IN THE FLUX OF 10 MeV SOLAR FLARE PARTICLES AND THEIR CONVECTION IN THE SOLAR WIND

Miriam A. Forman Sep. 1969 25 p refs
(Contract NAS2-3793)
(NASA-CR-114299; CSR-P-69-26) Avail: NTIS CSCL 03B

The Compton-Getting (convective) part of the equilibrium anisotropy in the flux of 10 MeV solar flare particles is calculated from particle spectra and solar wind speeds for seven events observed by the spacecraft Pioneer 6 and 7 in 1966. The convective part accounted for most of the anisotropy in every case, and in four cases appeared to be the entire anisotropy. This shows that convection is important and must be included in a realistic theory of the propagation of low energy solar cosmic rays, although it can be neglected at higher energies. Scattering by hydromagnetic waves may also be important. Furthermore, since the diffusive part of the anisotropy was radial when it was not zero, the diffusion of these particles appears to be, at least locally, isotropic. These conclusions depend on the facts that the convective part of the anisotropy is in the same direction as the solar wind, not perpendicular to the magnetic field, and that the correct formula for the Compton-Getting effect is (2 + alpha gamma) V/v. Author

N71-28125*# California Inst. of Tech., Pasadena. Hale Observatories.
PHOTOMETRY OF THE OUTER SOLAR CORONA FROM LUNAR BASED OBSERVATIONS
J. David Bohlin [1970] 25 p refs
(Grants NGR-05-002-034; NSF GA-1472)
(NASA-CR-118994) Avail: NTIS CSCL 03B

Two-dimensional isophotes of the extreme solar corona (max r is approx 45 solar radii) were derived from integrated vidicon pictures taken from the moon's surface by the unmanned probes Surveyors 6 and 7. These data were calibrated through use of previously published values for the coronal brightness gradient along the ecliptic. The resulting structure of the outer corona is compared to ground-based observations of the innermost corona (1.125 < or = to r/solar radius < or = to 2.0) made by the High Altitude Observatory K-coronameter. The possible existence of a streamer seen by Surveyor 7 is analyzed over the region 15 < or = to r < or = to 22.5 solar radii. Author

N71-28127*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ELECTRON AND BREMSSTRAHLUNG PENETRATION AND DOSE CALCULATION
John W. Watts, Jr. and M. O. Burrell Washington Jun. 1971 95 p refs
(NASA-TN-D-6385; M-440) Avail: NTIS CSCL 20H

Various techniques for calculation of electron and bremsstrahlung dose deposition are described. New energy deposition, transmission, and reflection coefficients for electrons incident on plane slabs for angles of 0, 30, 60, 75, and 89.9 deg and energies of 0.5, 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, and 10.0 MeV are presented, and methods for their use in electron dose calculations are developed. A method for electron dose calculations by approximation is also developed and the various methods are compared and found to be in good agreement. Accurate and approximate methods of calculating bremsstrahlung dose are also derived and compared. Author

N71-28167# Grumman Aerospace Corp., Bethpage, N.Y. Nuclear and Radiation Physics Section.
ACTIVATION OF THE CsI(Tl) TASC CRYSTALS IN THE HIGH ENERGY ASTRONOMY OBSERVATORY (HEAO) EXPERIMENT PACKAGE
M. C. Stauber Jun. 1971 15 p
(RM-507) Avail: NTIS

The High Energy Astronomy Observatory (HEAO) experiment package contains two large TASC (total absorption shower counter) crystals, CsI(Tl), to measure the energy of galactic gamma rays and of cosmic ray particles, housed in a spacecraft in a 200 nm earth orbit. During a portion of the orbit, ambient proton fluxes are encountered that produce neutrons in the spacecraft through (p, n) reactions. This neutron flux, on thermalization and capture in the crystals, produces the radionuclides I-128, Cs-134, and Tl-204. An analysis is presented of the resulting buildup of activity in the TASC crystals, and its interfering effect on the energy measurements of gamma ray and cosmic ray events. The analysis is based on detailed computations, as a function of the orbit parameters, the ambient proton fluxes, and their energy spectra. The number of neutrons produced per incident proton depends sensitively on the proton spectrum. The results of the calculations show that the scintillation background from the crystal activation at its peak value is well within the uncertainty of the energy determination in either experiment. Author

N71-28188# Catholic Univ. of America, Washington, D.C.
PRODUCTION OF LOW ENERGY MUONS BY NEUTRAL COMPONENTS OF THE COSMIC RADIATION AT SEA LEVEL Final Report
Clyde L. Cowan 31 May 1970 29 p refs
(Contract AT(30-1)-2419)
(NYO-2419-18) Avail: NTIS

The discussion of this experiment covers the telescope used and a summary of results thus far. The number of events found is 76 at a rate of 0.74 events per day. A charge ratio of negative muons to positive muons equals 1.15 is found. The zenith-angle distribution is also discussed. NSA

N71-28286 National Lending Library for Science and Technology, Boston Spa (England).
ON THE NATURE OF THE RADIATION BACKGROUND AT ALTITUDE 250-500 km
L. V. Kurnovova et al Oct. 1970 24 p refs Transl. into ENGLISH of Fiz. Inst. im Lebedva Akad. Nauk SSSR Preprint No. 123
(NLL-RTS-6033) Avail: Natl. Lending Library, Boston Spa, Engl.: 44s; 7 NLL photocopy coupons

The instrumentation on Cosmos 225 recording electron flux > 300 MeV and the data obtained are described. The operation of the telescope, scintillators, and gas and solid Cerenkov counters is outlined. The observation of electron bunches is discussed in detail, and it is suggested that electron bunches could occur if there were an accelerating mechanism. N.E.N.

N71-28308*# Maryland Univ., College Park. Dept. of Physics and Astronomy.
COSMIC RAY PROTON AND HELIUM MEASUREMENTS OVER HALF A SOLAR CYCLE 1965–1969
Thomas A. Rygg (M.S. Thesis) Jun. 1970 111 p refs
(Grants NGR-21-002-066; NGR-21-002-008; Nonr-710(19))
(NASA-CR-119013; TR-70-111) Avail: NTIS CSCL 04A

Cosmic ray proton and helium differential energy spectra covering the energy range 100 MeV/nucleon to 260 MeV/nucleon were obtained in balloon flights made each summer 1965 to 1969. The flights cover nearly the full extent of the solar cycle from solar minimum to solar maximum. The spectral contribution of atmospheric secondary protons is calculated, including the effect of solar modulation, and agrees with observations made with various detectors. The calculated secondary proton intensity varies 47% over the solar cycle. Integral proton and helium fluxes above 260 MeV/nucleon confirm the general rigidity dependence of solar modulation as predicted by most diffusion-convection models. However, the spectral results, including the proton flux from 260 MeV to 720 MeV obtained by ionization measurements, show that simple diffusion-convection theory does not explain the results below a few hundred MeV/nucleon. A model that assumes adiabatic deceleration of high energy cosmic rays is proposed to explain the low energy proton and helium results. Author

N71-28472*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CONSTANCY OF THE He TO MEDIUM NUCLEI RATIO IN THE SOLAR COSMIC RAYS
C. E. Fichtel and D. V. Reames Jun. 1971 15 p refs Submitted for publication
(NASA-TM-X-65583; X-662-71-112) Avail: NTIS CSCL 03B

A reply to a statistical study of solar protons, alphas, and Z > or = 3 nuclei is presented. On the basis of data obtained at low energies with a single-element solid state detector, the constancy of the helium to medium nuclei ratio and the justification for using it to estimate the solar helium abundance were questioned. Arguments are given to show that this is not a valid criticism, and that although the limited information provided makes interpretation difficult, the observed ratios, in fact, fall in a range that would be expected if the conditions existing at higher energies remain valid at lower energies. Author

N71-28567*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COSMIC RAY EFFECTS IN THE GUM NEBULA
R. Ramaty and E. A. Boldt Jun. 1971 18 p refs Presented

at Symp. on The Gum Nebula and Related Problems, Greenbelt, Md., 19 May 1971 Submitted for publication
(NASA-TM-X-65590; X-660-71-243) Avail: NTIS CSCL 03B

The effects of low energy heavy nuclei from the supernova explosion on nearby interstellar space are investigated. In addition to the ionization and heating of the Gum nebula, these particles may produce detectable fluxes of X-rays and gamma rays, both as continuum radiation and line emission. Author

N71-28593# Army Electronics Command, Fort Monmouth, N.J.
IONOSPHERIC EFFECTS (POSSIBLY FROM INTERNAL GRAVITY WAVES) UPON TOTAL ELECTRON CONTENT DURING THE SOLAR ECLIPSE OF 7 MARCH 1970
P. R. Arendt Dec. 1970 24 p refs
(AD-721589; ECOM-3376) Avail: NTIS CSCL 4/1

Variations of the total ionospheric electron content are assumed to indicate the motion of eclipse-produced internal atmospheric gravity waves. Variation of the electron content before, during, and after the eclipse of 7 March 1970 was obtained from polarizatent data is better than 2 degrees in polarization or 5 x 10 (to the power of 10) e/sq. cm in content. The maximum possible error of the content-variation measurements using our automatic ATS system is less than plus or minus 6 degrees of polarization or less than plus or minus 1.4 x 10 (to the power of 11) e/sq. cm in electron content. The average period of the content variations was found to be 18 plus or minus 3 minutes. From BEC observations across the predicted wake of the gravity waves, an estimate was made of the wavelength and velocity of the atmospheric undulations and found to be 320 km and 296 m/s, respectively. Author (GRA)

N71-28643# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
OPTICAL SPARK CHAMBER FOR THE SEARCH OF GAMMA RAY SOURCES [CHAMBRE A ETINCELLES OPTIQUE POUR LA RECHERCHE DE SOURCES DE RAYONS GAMMA]
J. Vasseur, J. Paul, B. Parlier, J. P. Leray, M. Forichon et al 1970 12 p refs In FRENCH; ENGLISH summary Presented at Symp. IAU on New Tech. in Space Astronomy, Garching, Germany, 10-14 Aug. 1970
(CEA-CONF-1633; Conf-700825-1) Avail: AEC Depository Libraries

In order to observe the NP 0532 pulsar in the energy range above 50 MeV, six balloon flights took place in 1969. The system included a pointed telescope equipped with an 850 sq cm optical spark chamber and a time-marker recording unit. A stereographic display allowed the reconstruction of the gamma-ray directions from the photographs of the sparks. The preliminary analysis indicated the probable existence of a pulsed emission of gamma rays coming from the Crab Nebula. Author (NSA)

N71-28942 Washington Univ., Seattle.
HIGH ENERGY COSMIC RAY INTERACTIONS IN EMULSION CHAMBERS
Robert Edward Gibbs (Ph.D. Thesis) 1969 161 p
Avail: Univ. Microfilms Order No. 70-14756

A horizontal plate emulsion chamber using alternate layers of plastic and emulsion has been designed and exposed to the primary cosmic radiation in high altitude balloon flights. The disintegration of cosmic ray heavy nuclei in the chamber provides a nearly monoenergetic beam of high energy nucleons. The subsequent interactions of these nucleons have been studied. The average multiplicity for proton collisions in hydrocarbons was determined. The angular distribution of created secondary particles was found to be less anistropic than thermodynamical model predictions. The average transverse momentum of protons and alpha particles from the primary break-up was higher than at lower energies. Dissert. Abstr.

N71-28943*# Translation Consultants, Ltd., Arlington, Va.
ON THE NATURE OF CERTAIN BACKGROUND RADIATION [O PRIRODE NEKOTORYKH FONOVYKH IZLUCHENIY]
O. F. Prilutskiy et al Washington NASA Jun. 1971 19 p refs Transl. into ENGLISH from the Russian Report
(Contract NASw-2038)
(NASA-TT-F-13615; PR-38) Avail: NTIS CSCL 03B

Possible sources of the sub-millimeter backgrounds of large intensities observed in the metagalaxy, the galaxy, and the terrestrial atmosphere are discussed. It is shown that the most natural assumptions about the sources of this background encounter significant difficulties. A proposed model based on the assumption that the background is produced by bremsstrahlug of photons with metagalactic sub-cosmic rays, is analyzed. It is shown that such a model leads to too large values of the temperature of the intergalactic gas and the intensity of photons and, consequently, should be rejected. Author

N71-28944*# Translation Consultants, Ltd., Arlington, Va.
A MODEL OF THE SOLAR WIND PLASMA-INTERSTELLAR MEDIUM INTERACTION [MODEL VZAIMODEYSTVIYA SOLNECHNOGO VETRA S MEZHZEVEZDNOY SREDOY]
V. B. Baranov et al Washington NASA May 1971 10 p refs Transl. into ENGLISH, of Acad. of Sci., USSR, Inst. for Space Res. Moscow, report Pr-28
(Contract NASw-2038)
(NASA-TT-F-13618; Pr-28) Avail: NTIS CSCL 03B

A model of solar wind plasma-interstellar medium interaction is considered. It is assumed, that the solar system moves through interstellar medium with velocity of about 20 km/sec. The velocity of the interstellar gas relative to the sun is decreased by solar wind plasma. Therefore two shocks are formed, in the instellar medium and in the solar wind plasma. It is assumed, that the region between these shocks is thin and it is the surface of discontinuity. The numerical solution of the differential equation for this surface is obtained. Author

N71-28945*# Translation Consultants, Ltd., Arlington, Va.
SOME CORONAL PLASMA TURBULENCE SPECTRA AND THE STRUCTURE OF A RADAR SIGNAL, NO. 1 [SPEKTRY TURBULENTNOSTI SOLNECHNOY KORONAL NOY PLAZMY I STRUKTURA RADIOLOKATSIONNOGO SIGNALA, 1]
I. M. Gordon et al Washington NASA May 1971 26 p refs Transl. into ENGLISH from the Russian Report
(Contract NASw-2038)
(NASA-TT-F-13614) Avail: NTIS CSCL 03B

Turbulence in the active regions of the solar corona is analyzed. A relatively limited problem, that of finding the distribution in the intensity of a reflected signal in terms of frequency shifts, and of comparing it with observations, is posed. The solution of this problem points to the possibility of determining the turbulence spectrum. Author

N71-28978*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TRAPPED PARTICLE RADIATION ENCOUNTERED BY SELECTED LOW ALTITUDE SKYLAB MISSIONS: SPACE STATIONS IN AN AMBIENT RADIATION ENVIRONMENT
E. G. Stassinopoulos Apr. 1971 27 p Submitted for publication
(NASA-TM-X-65584; X-641-71-155) Avail: NTIS CSCL 03B

A radiation study was conducted for a series of selected trajectories to facilitate decision-making during the early planning stages of the space platform program. For the specified flight paths, orbit tapes were generated from the latest ephemerides, taking into account normal perturbations wherever applicable, with an integration step-size of one minute in all cases. Each trajectory was generated for a sufficiently long flight time to insure an adequate sampling of the ambient environment. Orbital flux integrations were performed with Vette's current environment models.

The results, relating to omnidirectional, vehicle encountered, integral, trapped particle fluxes, are presented in graphical and tabular form. Orbit-integrated fluxes and spectra data are also tabulated and graphed, and 24 computer plots depicting the characteristic electron and proton spectra of the 12 trajectories are included. Graphs show the percent of total lifetime spend in (1) the trapped particle radiation belt; (2) high intensity regions of the Van Allen belt and percent of total daily flux accumulated during this time; and (3) flux-free regions of space. M.G.J.

N71-29027*# Techtran Corp., Glen Burnie, Md.
RADIATION IN THE UNIVERSE AND COSMIC ELECTRONS [IZLUCHENIYA VSLENNOY I KOSMICHESKIYE ELEKTRONY]
O. F. Prilutskiy et al Washington NASA Apr. 1971 28 p refs Transl. into ENGLISH from Russian report PR-22
(Contract NASw-2037)
(NASA-TT-F-13611; PR-22) Avail: NTIS CSCL 03B

Sources of background radiations which may be the integral radiations of the metagalaxy are discussed. Two hypotheses are analyzed. The first is the dual hypothesis, based on the assumption that the soft (radio) portion of background radiation is formed in synchrotron breaking, while X-radiation is formed in the course of the reverse Comptom effect. The second, or synchrotron hypothesis, assumes that all background radiation was formed by the breaking of electrons in the magnetic field. The conclusion is reached that the principal contribution to the background radiation is made by large Z. In the dual hypothesis the principal role is played by conventional galaxies, while within the framework of the synchrotron hypothesis the effects are produced by powerful radio galaxies and quasars. Author

N71-29089*# National Aeronautics and Space Administration, Washington, D.C.
MODELS OF THE TRAPPED RADIATION ENVIRONMENT. VOLUME 7: LONG TERM TIME VARIATIONS
1971 62 p refs Presented at Intern. Assoc. of Geomagnetism and Aeronomy Comm. 5 Sci. Session on Models of the Earth's Radiation Environ., Madrid, Sep. 1969
(Contract F04701-69-C-0066)
(NASA-SP-3024) Avail: NTIS CSCL 03B

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1. THE LOW ALTITUDE RADIATION ENVIRONMENT W. L. Imhoff (Lockheed Missiles and Space Co., Palo Alto, Calif.) p 3–21 refs (See N71-29090 16-29)

2. TIME HISTORY OF THE INNER RADIATION ZONE, OCTOBER 1963 – DECEMBER 1968 C. O. Bostrom, D. S. Beall, and J. C. Armstrong (Appl. Phys. Lab.) p 23–35 (See N71-29091 16-29)

3. LONG-TERM BEHAVIOR OF ENERGETIC INNER BELT PROTONS H. H. Heckman (Calif. Univ., Berkeley, Lawrence Radiation Lab.) P. J. Lindstrom (Calif. Univ., Berkeley, Space Sci. Lab.) and G. H. Nakano (Lockheed Missiles and Space Co.) p 37–47 refs (See N71-29092 16-29)

4. THE PARTICLE ENVIRONMENT AT THE SYNCHRONOUS ALTITUDE G. A. Paulikas and J. B. Blake (Aerospace Corp., El Segundo, Calif.) p 49–67 refs (See N71-29093 16-29)

N71-29090*# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
THE LOW ALTITUDE RADIATION ENVIRONMENT
W. L. Imhof *In* NASA, Washington Models of the Trapped Radiation Environ., Vol. 7 1971 p 3–21 refs (See N71-29089 16-29)
Avail: NTIS CSCL 03B

Observations of electrons and protons at low altitudes have provided valuable information relating to the source and loss mechanisms of particles trapped in both the inner and outer radiation belts. In the various latitude regions, the radiation environment is quite different in character. At the lower edge of the inner radiation belt the flux gradients of both electrons and protons are typically quite steep and the lifetimes rather short. Observations of redistributions of trapped electrons associated with magnetic storms and measurements of the long term decay of the Starfish radiation belt have indicated the occurrence of L-shell diffusion. Throughout the inner radiation belt the fluxes of trapped electrons having minimum altitudes below sea level are seen to vary with longitude, indicating the continual action of precipitation processes. In the slot region and the outer radiation belt the rates of buildup with longitude drift of the quasi-trapped electrons have been found to be consistent with the assumption that the dominant loss mechanism for trapped electrons is pitching-angle diffusion. Author

N71-29091*# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
TIME HISTORY OF THE INNER RADIATION ZONE, OCTOBER 1963–DECEMBER 1968
C. O. Bostrom, D. S. Beall, and J. C. Armstrong *In* NASA, Washington Models of the Trapped Radiation Environ., Vol. 7 1971 p 23–35 (See N71-29089 16-29)
(NASA Order R-21-009-004; Contract NOw-62-0604-c) Avail: NTIS CSCL 03B

Data from electron and proton detectors aboard satellite 1963 38C have been studied for the time period from September 1963 through December 1968. The region to be discussed is 1.2 < or = L < or = 3.0R sub e over the B-range accessible to the satellite in an 1100 km circular, polar orbit. For high energy electrons > or = 1.2 MeV) the major feature has been the steady decay of the artificial belt. By the end of 1968, Starfish electrons had essentially disappeared and there was no indication of a natural source for electrons with energy > or = 1.2 MeV. The low-energy (> or = 0.28 MeV) electron flux has been near enough to the natural levels since early 1966 to reveal the effect of natural events; these electrons undergo significant changes throughout the inner zone in response to major magnetic storms. In particular, the events in September 1966, May 1967, and November 1968 produced large changes in the low energy electrons and also in low energy protons, although the protons responded over a more limited region of L-space. Author

N71-29092*# California Univ., Berkeley. Lawrence Radiation Lab., Calif Univ., Berkeley.
LONG-TERM BEHAVIOR OF ENERGETIC INNER BELT PROTONS
H. H. Heckman, P. J. Lindstrom (Calif. Univ., Berkeley. Space Sci. Lab.), and G. H. Nakano (Lockheed Missiles and Space Co., Palo Alto, Calif., Res. Labs.) *In* NASA, Washington Models of the Trapped Radiation Environ., Vol. 7 1971 p 37–47 refs Sponsored in part by AEC Prepared jointly by Lawrence Radiation Lab., Berkeley, Calif., Calif. Univ., Berkeley, and Lockheed Missiles and Space Co., Palo Alto, Calif. (See N71-29089 16-29)
(Contract NAS9-5249)
Avail: NTIS CSCL 03B

Experimental results since late 1962 of the temporal behavior of low-altitude trapped protons, E > or = 57 MeV are summarized. These data are interpreted in terms of the time dependent continuity equation, using a source function that is empirically deduced from the data. The observed changes in the flux of 63-MeV protons between 1963 and mid-1969 are in agreement with those expected from solar-cycle changes in the atmosphere. Preliminary calculations that include semiannual as well as solar cycle atmosphere density variations indicate that beginning in 1967 semiannual changes in the 60-MeV proton flux should be observable at altitudes below about 350 km. Flux measurements are consistent with this computational results. Author

N71-29093*# Aerospace Corp., El Segundo, Calif. Space Physics Lab.

THE PARTICLE ENVIRONMENT AT THE SYNCHRONOUS ALTITUDE

G. A. Paulikas and J. B. Blake *In* NASA, Washington Models of the Trapped Radiation Environ., Vol. 7 1971 p 49–67 refs Supported in part by NASA (See N71-29089 16-29)
(Contract F04701-69-C-0066)
Avail: NTIS CSCL 03B

A state-of-knowledge report on the trapped energetic electrons and energetic solar protons observed at the synchronous altitude is presented. Important progress has been made in understanding the behavior of the particle population at this altitude, although large gaps still exist in our knowledge. The increase in knowledge has been exceptionally rapid because of the availability of a large volume of high-quality (nearly continuous) data from ATS 1 and other satellites. Author

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N71-28088*# Translation Consultants, Ltd., Arlington, Va.
MODEL OF THE ATMOSPHERE OF VENUS [MODEL ATMOSFERY VENERY]

M. Ya. Marov Washington NASA Jun. 1971 8 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 196, no. 1, 1971 p 67–70
(Contract NASw-2038)
(NASA-TT-F-13697) Avail: NTIS CSCL 03B

A model designed to generalize presently known data on the atmosphere of Venus is described. The bases of the model are the results of temperature, pressure, and gas composition measurements made by automatic stations Venera 4, Venera 5, and Venera 6 in the planet's troposphere. The measurements encompass a range of heights between 40 km and 20 km above the mean surface level. Author

N71-28089# Royal Aircraft Establishment, Farnborough (England).
THE ORBIT OF ARIEL 3 (1967–42A)

R. H. Gooding Dec. 1969 31 p refs
(RAE-TR-69275) Copyright. Avail: NTIS

The definitive orbit for Ariel 3 has been computed, from minitrack observations, for a period of 27 1/2 months from the launch of the satellite. The orbit was represented by a model with seven independent orbital parameters and the values of these parameters were determined, and are listed at three-day intervals. Typical accuracies are 0.00001 in eccentricity and 4 sec in angular parameters, that is, about 1/2 km in position. The expected decrease of about 0.02 deg, a curious feature of the secular variation of orbital inclination, appeared to occur over a three-month period instead of the full 27 1/2 month period. Author

N71-28090*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THRUSTING TRAJECTORY MINIMIZATION PROGRAM FOR ORBITAL TRANSFER MANEUVERS

Lawrence H. Hoffman, Richard N. Green, and George R. Young Washington Jun. 1971 52 p refs
(NASA-TN-D-6120; L-7440) Avail: NTIS CSCL 22A

A computer program was designed which determines the minimum-burn-time, thrusting, transfer trajectory between two Keplerian orbits. The minimization equations are formulated with constant Lagrange multipliers and solved numerically with the Newton-Raphson method. The solution obtained is not truly optimum because the control vector was restricted to constant values (i.e., to be optimum the control vector should be a function of time). The equations of motion for the transfer trajectory are those of a spacecraft maneuvering with constant thrust and mass-flow rate in the neighborhood of a single body. The thrust vector is allowed to rotate in a plane with a constant pitch rate. The transfer trajectory is characterized by six control parameters and the final orbit is determined or partially determined by the desired target parameters. The program is capable of varying from one to six control parameters to find the desired target parameters which are chosen from a large set. If the number of target parameters is less than the number of control parameters, the fuel required for the maneuver is minimized. To conserve computer time the equations of motion are integrated by a truncated power series in time. The use of the program is illustrated with three sample computer cases. Author

N71-28090# Grumman Aerospace Corp., Bethpage, N.Y. Systems Sciences Section.
A FAST METHOD OF SPACECRAFT TRAJECTORY COMPUTATION IN THE n-BODY INVERSE SQUARE FORCE FIELD

T. C. Fang May 1971 34 p refs Proposed for presentation at AAS/AIAA Astrodyn. Conf., Fort Lauderdale, Fla., 17–19 Aug. 1971
(RE-407) Avail: NTIS

A series solution without numerical integration was developed for fast computation of an approximate trajectory of a spacecraft traveling in the n-body inverse square force field. Due to the absorption of essential parts of Encke's perturbations into the closed form Keplerian solution, and elimination of numerical integration, the method developed is much faster than the methods of Encke or Cowell. The maximum deviation or error of approximation to true spacecraft trajectory can be predetermined. By adjusting either the time step or the number of terms used in the series, any specified limit of error can be specified. With a specified limit of error, the time step can be computed for an assumed number of terms used in the series. Closed form recurrence formulae, which can be used for on-board computers were developed in terms of initial spacecraft conditions for the expressions involved in the series. Author

N71-28091# Joint Publications Research Service, Washington, D.C.
RESULTS AND PROSPECTS OF COSMOPHYSICAL RESEARCH

M. Ya. Marov 8 Jun. 1971 33 p Transl. into ENGLISH from Priroda (Moscow), no. 4, 1971 p 18–34
(JPRS-53314) Avail: NTIS

Brief comments are presented on the development of space physics in the past 50 to 60 years. Advances in upper atmospheric concepts obtained from rocket and satellite launchings are outlined. Solar electromagnetic radiation and magnetic storm effects on the periodic variations in the structure of the thermosphere are discussed as well as mass spectrometric analysis of the upper atmosphere. Concepts concerning the physical features of the ionosphere, magnetosphere, and circumlunar space, and planetary environments are mentioned. Advances in radio astronomy and infrared radiometry are also discussed in relation to the atmospheres of Venus and Mars. J.M.

N71-28109*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE LUNAR ORBITER METEOROID EXPERIMENTS: DESCRIPTION AND RESULTS FROM FIVE SPACECRAFT

Gary W. Crew and Charles A. Gurtler Washington Jun. 1971 44 p refs
(NASA-TN-D-6286; L-7800) Avail: NTIS CSCL 22A

Meteoroid experiments by five Lunar Orbiters have provided

a direct measurement in the near-lunar environment of the rate of meteoroid penetration of 0.025 mm thick beryllium copper. Each experiment used 20 pressurized-cell detectors having a total effective exposed area of 0.186 sq m. The spacecraft carrying the cells were in both equatorial and polar orbits; altitudes ranged between 30 and 6200 km. Data collected continuously for 17 months indicate that the rate of penetration in the lunar environment is approximately half the rate in the near-earth environment as measured by detectors of the same type aboard Explorers 16 and 23. Author

N71-28121*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LUNAR GRAVITATIONAL FIELD: A THIRTEENTH DEGREE AND ORDER SPHERICAL HARMONIC ESTIMATE
W. T. Blackshear, E. F. Daniels, and S. G. Anderson Washington Jun. 1971 19 p refs
(NASA-TM-X-2260; L-7401) Avail: NTIS CSCL 03B

Lunar Orbiter tracking data were analyzed to yield a thirteenth degree and order spherical harmonic approximation to the lunar gravitational potential function. The results of the analysis indicate an essentially homogeneous moon and demonstrate a correlation between lunar surface features and gravitational anomalies. In addition, a correlation exists between the type of data coverage and the general character of acceleration anomalies calculated from the potential approximation. Author

N71-28145# Joint Publications Research Service, Washington, D.C.
SOVIET-BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 253
1 Jun. 1971 117 p Transl. into ENGLISH from Russian reports (JPRS-53253) Avail: NTIS

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N71-28146# Joint Publications Research Service, Washington, D.C.
ASTRONOMY
In its Soviet-Bloc Res. in Geophys., Astronomy, and Space, No. 253 1 Jun. 1971 p 1–5 (See N71-28145 16-30)
Avail: NTIS

News briefs concerning developments in astronomy are presented. The articles include a description of the radioastrophysical observatory in Latvia, astronomy in Mongolia, structure of radio emission sources, and discovery of a supernova in the constellation Virgo. F.O.S.

N71-28156*# Harvard Univ., Cambridge, Mass. Dept. of Geological Sciences.
RADIOACTIVE HEAT SOURCES IN THE LUNAR INTERIOR
James Fred Hays [1971] 34 p refs
(Grant NGR-22-007-175)
(NASA-CR-116892) Avail: NTIS CSCL 03B

Thermal models are investigated in order to set upper limits on lunar radioactivity consistent with the proposed temperature distribution. For an initially cold, uniform moon, devoid of potassium, a maximum uranium content of 23 parts per billion is inferred. This is about twice the chondritic value and an order of magnitude less than the least radioactive lunar rock samples. Accretional heating and more realistic K/U ratios imply still lower uranium contents. Surface concentration of radioactive heat sources is probable only if deep melting has occurred. This, too, implies present day central temperatures greater than 1400 C. Either the moon has a most unusual geochemistry or the temperature distribution, inferred from apparent electrical conductivity of the lunar interior, is grossly in error. Author

N71-28192*# Scripta Technica, Inc., Washington, D.C.
THE WARM JACKET OF THE MOON [TEPLAYA SHUBA LUNY]
V. S. Avduyevskiy et al NASA Jun. 1971 4 p Transl. into ENGLISH from Priroda (Moscow), No. 3, Mar. 1971 p 73–74
(Contract NASw-2036)
(NASA-TT-F-13701) Avail: NTIS CSCL 03B

The density, thermal capacity, and thermal conductivity of a regolith specimen from the lunar surface is investigated. The specimen was taken from zone A of the core, weighed about 2 grams and in external appearance resembled graphite powder. Average size of the powder particles was about 25 millimicrons. Finer and coarser particles were also present. Examinations were made in a hermetically sealed chamber filled with high purity helium. E.H.W.

N71-28316*# California Univ., Santa Barbara.
ENERGY TRANSFER IN PLANETARY ATMOSPHERES: OPTICAL SPECTROSCOPIC STUDIES Final Technical Report, 1 Dec. 1970–30 May 1971
H. P. Broida 30 May 1971 20 p refs
(Grant NGR-05-010-044)
(NASA-CR-119022) Avail: NTIS CSCL 03B

Several different cross sections have been measured in the laboratory for the production of electronically excited species that are observed in the atmospheres of the planets. Spectra of CO2(+) band systems produced by the interaction of CO2 with He(23S) metastable atoms are similar to spectra observed in the atmosphere of Mars. Experimental transition probabilities of the CO2(+) band system produced by this energy transfer process were measured using spectra with 0.02 nm resolution. Recombination of the resultant CO2(+) gave large concentrations of CO alpha 3 pi. Decay of CO Cameron bands in a flow tube allowed a measurement of the lifetime of the CO metastable. Spectroscopic emission from the interaction of 58.4 nm photons with N2, O2, CO, NH3, and N2O has been compared with the photon interaction with CO2. Absolute cross sections were measured for the production of each vibrational level of all observed electronically excited states. Helium metastable atoms have been used to produce metastable CS(alpha 3 pi) by the interaction of CS2 with a helium afterglow. Author

N71-28317# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
APPROXIMATE EQUATIONS FOR EVALUATING THE IMPACT DISPERSION RESULTING FROM REENTRY WINDS AND DEVIATIONS IN DENSITY
L. S. Glover Sep. 1970 65 p refs
(Contract N00017-62-C-0604)
(AD-721336; APL-TG-1132) Avail: NTIS CSCL 16/2

The effects on impact dispersion of winds and density deviations from a standard atmosphere are usually determined by a three- or six-degree-of-freedom trajectory simulation. However, for preliminary design studies and for implementing targeting corrections for wind and density effects, approximate equations for evaluating impact dispersion are required. The necessary equations have been derived and are presented herein. Impact errors computed

using the simplified equations are in excellent agreement with three-degree-of-freedom simulation results for the types of trajectories used for current long-range ballistic missiles. Author (GRA)

N71-28509*# Princeton Univ., N.J.
ASTRONOMICAL USE OF TELEVISION-TYPE IMAGE SENSORS
V. Richard Boscarino, ed. Washington NASA 1971 217 p refs Presented at the Proc. of a Symp. held at Princeton, N.J., 20–21 May 1970; sponsored by NASA and Am. Astron. Soc.
(NASA-SP-256) Avail: NTIS CSCL 03A

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15. IMAGE PROCESSING OF STRATOSCOPE PHOTOGRAPHS R. E. Danielson and M. G. Tomasko (Princeton Univ., Obs.) p 199–206 refs (See N71-28524 16-14)

16. THE PROCESSING OF ELECTRONIC CAMERA IMAGES G. E. Kron (Naval Obs., Wash., D.C.) p 207–217 refs (See N71-28525 16-09)

N71-28510*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
EXPERIENCE FROM MARINER TV EXPERIMENTS
G. Edward Danielson, Jr. *In* Princeton Univ. Astron. Use of Television-Type Image Sensors 1971 p 1–12 refs (See N71-28509 16-30)
(Contract NAS7-100)
Avail: NTIS CSCL 03B

The characteristics of the data relevant to obtaining photometric and geometric scientific information about the Martian surface by television cameras equipped with vidicons operated in slow scan on the Mariner 1964 and 1969 missions are described. Extensive prelaunch calibrations of these cameras were carried out to determine such properties as light-transfer functions, erasure or residual characteristics of the vidicons, thermal and temporal effects, and spectral response of each complete system. These calibrations data characterized each picture element of the flight vidicons. The known properties which limit both photometric and geometric measurements in the data are discussed. Author

N71-28514*# University Coll., London (England). Physics Dept.
AN IMAGE PHOTON COUNTING SYSTEM FOR OPTICAL ASTRONOMY
A. Boksenberg *In* Princeton Univ. Astron. Use of Television-Type Image Sensors 1971 p 77–84 (See N71-28509 16-30)
Avail: NTIS CSCL 03A

A system for photon event counting by television recording coupled to an optical image intensifier is discussed for use as a multichannel photon counter. The advantages of this system are given along with the proposed tasks to be performed. It is concluded that an approach is presented that shifts that emphasis from the detailed photometric performance of the photoelectronic devices to the real-time data processing of the fundamental signals. F.O.S.

N71-28516*# California Inst. of Tech., Pasadena. Div. of Geological Sciences.
AN APPLICATION OF THE SILICON VIDICON TO ASTRONOMICAL PHOTOMETRY
J. A. Westphal and T. B. Mc Cord (MIT) *In* Princeton Univ. Astron. Use of Television-Type Image Sensors 1971 p 107–108 ref (See N71-28509 16-30)
Avail: NITS CSCL 03A

A diode matrix silicon vidicon which is being adapted for astronomical photometry is described. The tests show that, by moderate cooling, the diode dark current can be essentially eliminated. Difficulties with back lighting from the read gun filament presently limit exposure-readout times to about 10 seconds, however, mechanical modifications of the tube will remove this difficulty. The wide spectral range, combined with exact linearity, large dynamic range and high quantum efficiency will make this device extremely useful for planetary and stellar photometry. Author

N71-28520*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
VIDEO DATA PROCESSING FOR THE CELESCOPE EXPERIMENT
R. J. Davis, W. A. Deutschman, K. Haramundanis, Y. Nozawa, and K. O'Neill *In* Princeton Univ. Astron. Use of Television-Type Image Sensors 1971 p 137–144 refs (See N71
(Contract NAS5-1535)
Avail: NTIS CSCL 03A

The reconstruction of the ultraviolet brightness of stars by SAO from video data obtained in the Celescope experiment is described. Noise and background is separated from the signal, and adjacent signal elements are combined for determining total signal amplitude and raster position. The signal amplitude and raster position are then converted into ultraviolet intensity and true position in spacecraft coordinates. The results are reviewed for consistency and accuracy before publication as a catalog of ultraviolet brightness. Author

N71-28786 California Univ., Los Angeles.
THE NEUTRAL HELIUM LINES IN NORMAL B-TYPE SPECTRA
David Stanley Leckrone (Ph.D. Thesis) 1969 316 p
Avail: Univ. Microfilms Order No. 70-14300

Spectroscopic observations of the profiles of a number of neutral helium lines have been obtained for five main sequence B stars. The helium abundances of three of these stars, upsilon Orionis, HR 2154 and pi Cati have been estimated. Published profile and equivalent width data for the neutral helium lines of Lota Herculis and gamma Pegasi have been utilized in estimating their helium content. The five stars analyzed range in spectral type from BO to B7. The analysis emphasized the application of model atmospheres and line broadening theory to the synthesis of the observed profiles of seven isolated neutral helium lines. Effective temperatures and surface gravities were estimated by use of the observed spectral energy distributions and Balmer line profiles. The observed broadening of the MgII 4481 line yielded estimates of the stellar rotational velocities. Instrumental broadening was accounted for. Dissert. Abstr.

N71-28787 California Univ., Los Angeles.
NUMERICAL INTEGRATION TECHNIQUES AND ORBIT DETERMINATION APPLIED TO JUPITER'S NINTH AND TWELFTH SATELLITES
George Emerson Newnam, II (Ph.D. Thesis) 1969 116 p
Avail: Univ. Microfilms Order No. 70-14309

Up to date orbits of Jupiter's ninth and twelfth satellites are determined, integration techniques which are applicable to the problem are compared, and a method for increasing the integration step size using the variation of parameters method is investigated. Three separate areas considered are orbit determination using Cowell's method, comparison of Cowell's integration techniques with variation of parameters, and experimentation with the variation of parameters integration. A flow chart and a description of the computer program involved is given for each of the three areas of investigation. The 1969 Ephemerides of Jupiter's ninth and twelfth satellites is presented along with the pertinent elements of each satellite orbit. Dissert. Abstr.

N71-28788 Michigan Univ., Ann Arbor.
THE ORIGIN AND DYNAMICAL EVOLUTION OF THE SOLAR SYSTEM
Jack Gilbert Hills (Ph.D. Thesis) 1969 175 p
Avail: Univ. Microfilms Order No. 70-14544

It is shown that if the specific energy and angular momentum of the solar nebula have been conserved in the planets, the solar nebula could not have extended more than 11 AU from the sun, which suggests that the three outermost planets were ejected into their present orbits by encounters with the inner planets. A model is developed for the growth of the planets in the solar nebula. This has for one of its consequences Jupiter and Saturn being the outermost planets to form in the nebula. This again suggests the dynamical evolution of planets after their formation. The present orbital stability of the planets and satellites in the solar system is examined. Eleven models of planetary systems were dynamically evolved on an electronic computer from random initial conditions. The relative numbers of planetoids ejected from the solar system, ejected into long period orbits beyond Neptune, and accreted by the Jovian planets have been calculated. It is found that the basic properties of satellite systems can be explained by a pure capture theory. Dissert. Abstr.

N71-28789 Illinois Univ., Urbana.
AN INTERCOMPARISON OF THREE SPECTROSCOPIC LUMINOSITY CRITERIA
Thomas Edwart Lutz (Ph.D. Thesis) 1969 98 p
Avail: Univ. Microfilms Order No. 70-13403

Visual binary stars are utilized to estimate the external errors of and systematic differences between the K line absolute magnitude system, a line-ratio luminosity system, and a revised H sub gamma luminosity system. The K line method is examined critically. An objective method of measuring the emission width through the use of direct intensity microphotometer tracings is described. A line-ratio luminosity system is formed using moderate dispersion spectrograms. A direct comparison between the K line and line-ratio luminosity systems is possible because the spectral ranges to which these methods apply overlap. Comparison between these two systems and the H sub gamma system can be made using visual binary stars. The external errors are estimated to be + or − 0.3 + or − 0.5 and + or − 0.5 mag. for the K line, line-ratio, and H sub gamma luminosity systems, respectively. Systematic differences between the luminosity systems are found to be in the range + or − 0.5 mag. Dissert. Abstr.

N71-28793 Illinois Univ., Urbana.
EXTRAGALACTIC RADIO SOURCES IN UNIFORM MODEL UNIVERSES
Richard Ray Ringenberg (Ph.D. Thesis) 1969 101 p
Avail: Univ. Microfilms Order No. 70-13456

Several Formulae are derived in zero-pressure uniform model universes. These formulate pertain to the distribution of extragalactic radio sources in space. The source count formula, which applies in any model universe, is derived. The sources have an arbitrary dispersion in luminosity and a general evolution function. Several additional theoretical relationships are then worked out. These give the formulae for the background radiation, the background radiation of certain classes of sources, the confusion noise, the luminosity distribution, and the fraction of distant sources in certain regions in flux density. Observational data are introduced and previous analyses of the source counts are examined. It is then shown that it is possible to find solutions for the evolution function for certain types of evolution. Numerical solutions are found by computer. Once numerical solutions for the evolution function are found, several auxiliary calculations are made which relate to other observable quantities. Dissert. Abstr.

N71-28827*# Techtran Corp., Glen Burnie, Md.
USE OF THE GRAVITATIONAL FIELD OF VENUS TO CONTROL THE FLIGHT TRAJECTORY OF A SOLAR PROBE [ISPOLZOVANIYE GRAVITATSIONNOGO POLYA VENERY DLYA UPRAVLENIYA TRAYEKTORIYEY POLETA SOLNECHNOGO ZONDA]
G. A. Mersov et al Washington NASA Apr. 1971 28 p refs Transl. into ENGLISH from the Russian report
(Contract NASw-2037)
(NASA-TT-F-13608; D-34) Avail: NTIS CSCL 22A

The technique of circumnavigation of Venus is used to reduce the flight duration of a solar probe prior to the moment of setting. It is estimated that the technique will cut the flight time from 1.2 years to 0.6 years. Author

N71-28833 Ohio State Univ., Columbus.
A SURVEY BETWEEN 0 DEG AND 20 DEG NORTH DECLINATION USING THE OHIO STATE UNIVERSITY RADIO TELESCOPE AT 612, 1415, AND 2650 MEGAHERTZ
Lewis Thomas Fitch (Ph.D. Thesis) 1969 272 p
Avail: Univ. Microfilms Order No. 70-14015

A survey of the radio sky has been in progress for the past five years using the radio telescope. The instrumentation and procedures used to operate the radio telescope at three frequencies simultaneously are described. A listing and maps of the results of the survey, and comparisons to results obtained at other observatories are given for evaluating the accuracy of the results. The survey covers about 4,000 square degrees of sky between the declinations mentioned, and lists 2,101 radio sources whose 1415 MHz flux densities were measured as being above 0.2 flux units. 612 MHz peak flux densities are also given for about 1200 of these sources

and 2650 MHz peak flux densities are given for 115 sources whose flux densities were found to be above 0.6 f.u. Spectral indices are given for the sources measured at 612 MHz, and some three point spectra are shown for the previously uncatloged sources detected at 2650 MHz. Dissert. Abstr.

N71-28830# Case Western Reserve Univ., Cleveland, Ohio.
A SEARCH FOR HIGHLY LUMINOUS STARS IN THE SOUTHERN MILKY WAY Final Report
Charles B. Stephenson Apr. 1971 5 p refs
(Contract N00014-70-C-0131)
(AD-722041) Avail: NTIS CSCL 3/1

In order to create a finding list of stars known to be at very large distances from the sun and also known to be relatively young objects which trace out the spiral structure of our galaxy, objective prism plates taken at Cerro Tololo InterAmerican Observatory have been used to survey the southern Milky Way for stars earlier than spectral type GO and at least as intrinsically luminous as a B2 dwarf. The survey is now complete, and its completion means that the entire Milky Way has now been surveyed in this way down to about photographic magnitude 12. Our catalogue, which is still being prepared for publication as of this writing, contains 5132 stars, about the same number as found in the somewhat larger area of sky represented by the northern Milky Way. The survey has also identified large numbers of individually interesting stars of othe types, some of which we have already published and others of which will be followed up in future in separate publications. Author (GRA)

N71-28870 Princeton Univ., N.J.
HELIUM CORE FLASH HYDRODYNAMICS
Martin George Tomasko (Ph.D. Thesis) 1969 41 p
Avail: Univ. Microfilms Order No. 70-14245

The importance of hydrodynamical effects during the helium core flash phase of stellar evolution is investigated in two parts. First, the cores of hydrostatically computed stellar models at the peak of the helium flash are shown to be pulsationally stable having periods of approximately 30 seconds and damping times of from about 20 to more than 100 periods depending on peak flash height. This may indicate that hydrodynamical effects generally do not greatly alter the course of the flash. Second, the hydrodynamical consequences for the outer regions on the star are investigated based on the assumption that the core flash follows previous hydrostatic computations. Linearized numerical computations of the traveling wave launched by the expansion of the core occurring during the flash indicate that the wave loses most of its energy by lifting the passed over material to a new hydrostatic equilibrium, and can lead to a loss of less than some .00001 of the star's mass when it reaches the surface. Dissert. Abstr.

N71-28906 Oklahoma Univ., Norman.
WATER RESOURCES IN THE LUNAR ENVIRONMENT
Ralph Heywood Ramsey, III (Ph.D. Thesis) 1970 164 p
Avail: Univ. Microfilms Order No. 70-14427

An attempt was made to examine the needs of man and the effects of the spatial environment, particularly that of the moon, on water regimes within a space station. It would be possible to provide water for employment in its customary roles, but the imposition of the constraints produced by transport costs and energy requirements must be taken into consideration in planning and design. Problem situations in the areas of water supply and transport, water use, and water treatment were posed, and alternative strategies were identified as possible solutions. Numerous schemes can be employed to reduce the amounts of water needed for domestic purposes. Dry solutions can be made available for all of the common uses. Through proper selection from the available alternatives, base water systems could be designed so that no decrease in the efficiency of the purported domestic use will occur. Dissert. Abstr.

N71-28950*# Techtran Corp., Glen Burnie, Md.
DETERMINATION OF SEVERAL GEOMETRIC, DYNAMIC AND GRAVITATIONAL PARAMETERS OF A PLANET BY MEANS OF PHOTOGRAPHS FROM SPACECRAFT, GROUND TRACKING AND ASTRONOMICAL OBSERVATIONS [OPREDELENIYE NEKOTORYKH GEOMETRICHESKIKH, DINAMICHESKIKH I GRAVITATSIONNYKH PARAMETROV PLANETY PO SNIMKAM S KOSMICHESKIKH APPARATOV, NAZEMNYN TRAYEKTORNYM I ASTRONOMICHESKIM NABLYUDENIYAM]
E. P. Alekseshin et al Washington NASA Apr. 1971 12 p refs Transl. into ENGLISH from the Russian report
(Contract NASw-2037)
(NASA-TT-F-13607; D-16) Avail: NTIS CSCL 03B

A method is examined for joint determination of the parameters characterizing the gravitational field, rotation, and orbital motion of a planet as well as determination of the fundamental coordinates of points on its surface forming a global reference network. A method is given for calculating the desired parameters. A plan is presented for the joint statistical analysis of all measurements with maximum probability. Author

N71-28976*# Translation Consultants, Ltd., Arlington, Va.
A SIMPLE ALGORITHM FOR ROTATING THE PLANE OF AN ORBIT IN THE CENTRAL AND NONCENTRAL GRAVITATIONAL FIELD OF THE EARTH [PROSTOY ALGORITM POVOROTA PLOSKOSTI ORBITY V TSENTRAL'NOM I NETSENTRAL'NOM GRAVITATSIONNOM POLE ZEMLI]
V. V. Veselovskiy Washington NASA May 1971 40 p refs Transl. into ENGLISH from the Russian report
(Contract NASw-2038)
(NASA-TT-F-13613) Avail: NTIS CSCL 22A

The problem of the repeated passage of a satellite over a given point on the terrestrial surface is discussed. A simple algorithm is proposed for rotating the plane of the osculating orbit which is initially described as an example in the central gravitational field of the earth and then extended to the noncentral field, which is taken into account with an accuracy up to the first harmonic. The functional is derived on which is based the switching on and switching off of propulsion and the accuracy of the thrust cut-off is checked for the size of the miss during repeated passage of the satellite. It is shown that for certain assumptions, the satellite's equations of motion are separable. An estimate of the error in the solution for the simplified problem is carried out. Author

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N71-28951# Royal Aircraft Establishment, Farnborough (England).
THE DIADEM SATELLITES (D-1C AND D-1D) [LES SATELLITES DIADEME, D-1C ET D-1D]
Dec. 1970 96 p Transl. into ENGLISH from French report
(RAE-LIB-TRANS-1501) Avail: NTIS

The Diademe D-1C and D-1D satellites for spatial experiments in geodesy and location are described. The aims of the project and the studies peculiar to these satellites, namely the laser reflectors, the stabilization system, and the thermal control are discussed. The satellite design, experiments to be performed, telemetry, power supplies, and the stabilization system are described. Finally, the data are presented on the tests carried out on the satellites and components before launching. The performances of the satellites after launching are included. Author

N71-28082# Joint Publications Research Service, Washington, D.C.
ORBITAL STATIONS AND THE STUDY OF EARTH FROM SPACE
B. Petrov 3 Jun. 1971 10 p Transl. into ENGLISH from Aviat. Kosmonavt. (Moscow), no. 5, 1971 p 32–33
(JPRS-53281) Avail: NTIS

The problems faced in the assembly of space ships or space stations in orbit are discussed. Suggestions for solving the problem include development of methods and systems envisaging the mutual tracking of two ships, place into near orbits, including maneuvering, approach, docking, rendezvous, and upcoupling, by means of complete automation and with the participation of an astronaut. Author

N71-28115*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECTS OF RETROROCKET EXHAUST ON DRAG OF 120 DEG CONE AT SUBSONIC SPEEDS
Edwin E. Davenport and Edwin E. Lee, Jr. Washington Jun. 1971 26 p refs
(NASA-TM-X-2275; L-7661) Avail: NTIS CSCL 20D

An investigation was made in the Langley 16-foot transonic tunnel of a series of blunted cones equipped with simulated retrothrust nozzles. Three retrorocket configurations (4, 8, and 12 jets) which would be possible planetary entry candidates were tested at an angle of attack of 0 deg at Mach numbers of 0.30, 0.40, and 0.50. The results showed considerable interaction between retrothrust exhaust and aerodynamic drag. It would appear advantageous to jettison the front cone face when ablation requirements had been fulfilled. Author

N71-28128# Royal Aircraft Establishment, Farnborough (England).
EARTH RESOURCES SATELLITES
S. L. Entres Oct. 1969 88 p
(RAE-TR-69219) Copyright. Avail: NTIS

Operational and technical aspects of earth resources satellite projects are discussed. Two basic surveying methods are considered; by remote sensing satellites and by measurement-collecting satellites. Attention is concentrated on problems of orbital sensing of electromagnetic earth radiance in the visual, infrared and microwave regions. The principles of polychromatic measurement of earth surface radiation signatures and their analysis as well as some matters connected with the data handling of the sensed information are discussed. Recommendations are made for some useful fields of study and for complementary experimental work. A list of organizations engaged in relevant branches of science and technology together with classified bibliographic references are appended. Author

N71-28140# Royal Aircraft Establishment, Farnborough (England).
THE BLACK ARROW X3 SPACECRAFT
H. J. H. Sketch Sep. 1969 31 p Presented at 8th Intern. Symp. on Space Technol. and Sci., Tokyo, Aug. 1969
(RAE-TR-69203) Copyright. Avail: NTIS

The X3 spacecraft in the Black Arrow series is currently under construction and it is planned to carry the following experiments: (a) an experiment to determine the stability of a number of new surface finishes for thermal control, (b) an experiment to determine the behaviour of new silicon solar cell assemblies including ultralight weight silicon cells, (c) an experiment in hybrid electronic assemblies, and (d) an experiment by Birmingham University to determine the flux of micrometeoroids. The structure has the shape of a pumpkin 1.1 m in diameter and 0.7 m in length and it is without either booms or paddles. The satellite is spin-stabilised, the all-up weight is about 72 kg, the orbit is near polar, the expected operational lifetime is one year and it will be launched in 1971. Author

N71-28166*# National Aeronautics and Space Administration, Washington, D.C.
COMPARTMENT VENTING: SPACE VEHICLE DESIGN CRITERIA
Nov. 1970 31 p refs
(NASA-SP-8060) Avail: NTIS CSCL 22B

Guidance for the analysis, selection, and verification of a means providing adequate venting of gases between internal and external compartments and the external atmosphere on spacecraft is presented. The prediction of flow rates through planned and unplanned vents and the internal environments and pressure differentials across compartment walls is also treated. Verification of vent system performance through analysis and testing is also discussed. E.H.W.

N71-28172*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
APOLLO/SATURN 5: CONSOLIDATED INSTRUMENTATION PLAN FOR AS-510 (APOLLO 15)
11 Jun. 1971 72 p
(NASA-TM-X-67185; K-V-059/10) Avail: NTIS CSCL 22B

The consolidated instrumentation plan is presented for employing optical and electronic data acquisition systems to monitor the performance and trajectory of Apollo Saturn V vehicle 510 during the launch phase of the mission (prelaunch, liftoff to insertion). Telemetry, optical, and electronic tracking equipment onboard the vehicle and data acquisition systems monitoring the flight are discussed. Flight Safety instrumentation, vehicle data transmission systems, and geophysical instrumentation are also described. Author

N71-28318*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RAE-B LAUNCH OPPORTUNITY ANALYSIS
Hobart Swartwood, Jr. May 1971 20 p refs *Its* RAE-B Mission Analysis Rept. No. 1
(NASA-TM-X-65587; X-551-71-206) Avail: NTIS CSCL 22D

Launch opportunities for the Radio Astronomy Explorer-B during the period March through December 1973 are determined. It is assumed that the fight time to the Moon is 110 hours; that all rocket engine burns are impulsive; and that the maximum allowable velocity increment to insert into and circularize the lunar orbit is 0.720 km/sec. Thermal and power requirements constrain the spin axis-Sun angle to be maintained between 60 and 120 deg throughout the lunar transfer. The circular lunar orbit is required to be inclined 116.5 deg to the lunar equator; to be at an altitude of 1100 km; and to be entirely in sunlight for at least 50 days. Shadows during the park orbit, injection, and transfer phases are determined. It is shown that imposition of the above assumptions and constraints yields from two to seven launch opportunities per month if no transfer shadows are allowed and no restrictions are placed on park orbit duration or shadows. Most of the prime launch dates have one acceptable launch opportunity, but a few have two. Author

N71-28319*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PLANETARY EXPLORER STRUCTURAL CONCEPT EVALUATION MODEL USING NASTRAN
Dennis R. Hewitt Apr. 1971 42 p refs
(NASA-TM-X-65585; X-762-71-181) Avail: NTIS CSCL 22B

A structural evaluation of the phase A configuration of the Planetary Explorer spacecraft used the NASA structural analysis program NASTRAN. The modeling techniques used to create a versatile model while reducing computer running time are described. The evaluation predicted the optimum position of structural members, load paths, and deflections. Author

N71-28829*# National Aeronautics and Space Administration, Washington, D.C.
INTERACTIONS WITH UMBILICALS AND LAUNCH

STAND: SPACE VEHICLE DESIGN CRITERIA (STRUCTURES)
Aug. 1970 23 p refs
(NASA-SP-8061) Avail: NTIS CSCL 22D

Criteria is provided and practices recommended to ensure compatible interfaces between space-vehicle structure and launch-stand GSE. Current practice is appraised, with emphasis on the proper consideration of interaction between the vehicle structure and launch-stand GSE. For simplicity and clarity, the discussion is divided into five subjects: (1) interface identification, (2) openings and penetrations, (3) umbilicals, (4) platforms and access ladders, and (5) structures and hard points. Launch-stand GSE includes access platforms, umbilicals, launch mounts, service towers, checkout equipment, tools, and all other mechanical interfaces at the launch stand. The space-vehicle structure includes launch-vehicle structure, spacecraft structure, and shroud structure. Author

N71-28837# Sandia Corp., Albuquerque, N.Mex.
AEROSPACE NUCLEAR SAFETY PROGRAM Quarterly Report, 1 Oct.–31 Dec. 1970
A. J. Clark, Jr. and R. G. Illing, comp. Dec. 1970 28 p Sponsored by AEC
(SC-PR-70-882) Avail: NTIS

The research, development, support, and test activities are described. Five trajectories were selected for thermal stress analysis of the Pioneer heat shield; thermal stress calculations were carried out for two of the trajectories, and the results indicated no thermal stress failure of the heat shield; however, the remaining three trajectories will generate much more severe thermal stresses. The low and high yield overpressure tests of complete Pioneer RTGs were conducted; in both tests, the generator housing and the graphite heat shield were shattered and the bare capsule was found intact. The low velocity fragment test of a Pioneer capsule was conducted; the capsule was recovered intact, but the clad was breached and the strength member was exposed. Two liquid fire tests were performed using Pioneer capsules; neither capsule was significantly damaged. The final safety analysis summary for Have Sinew-1 is being prepared. The handling, installation, and health physics procedures for Te-182 are complete. NSA

N71-28851* National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
ORBITAL ESCAPE DEVICE Patent
Caldwell C. Johnson, inventor (to NASA) Issued 11 Jul. 1967 9 p Filed 19 Jan. 1967 Cl. 244-138
(NASA-Case-XMS-06162; US-Patent-3,330,510; US-Patent-Appl-SN-610724) Avail: US Patent Office CSCL 22B

An orbital escape vehicle which can be folded and stowed aboard an earth orbiting, manned spacecraft and used to safely return a crewman to the earth's atmosphere in the event of an emergency is described. The vehicle is comprised of a flexible casing having an ingress-egress opening, a heat ablative covering, and an inflatable bladder system for supporting the crewman and for maintaining a stable aerodynamic shape during reentry into the atmosphere. Official Gazette of the U.S. Patent Office

N71-28948*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
EXPANDABLE SPACE FRAMES Patent Application
Alan H. Schoen, inventor (to NASA) 25 p Filed 17 Dec. 1970
(NASA-Case-ERC-10365; US-Patent-Appl-SN-99198) Avail: NTIS CSCL 22B

Expandable space-frames formed of a plurality of hinge joint assemblies and struts are reported. The space-frames are utilized in various types of structures. They can form a basic building structure or can be utilized in a planar manner to form the floors and walls of a structure. Moreover, they can be utilized in space to define a structure such as a manned orbiting laboratory. NASA

N71-28948*# Scientific Translation Service, Santa Barbara, Calif.
SEVERAL PROBLEMS OF DESIGNING SPACE VEHICLES WITH THREE AXIS ATTITUDE CONTROL [NEKOTORYYE VOPROSY PROYEKTIROVANIYA KOSMICHESKIKH APPARATOV S TRYOKHOSNOY ORIYENTATSIEY]
L. M. Lisovich et al Washington NASA May 1971 13 p Transl. into ENGLISH from the Russian Report
(Contract NASw-2035)
(NASA-TT-F-13609; D-51) Avail: NTIS CSCL 22B

A description is given of spacecraft using a planar solar panel as the electrical power generator. A three-axis attitude control system enables the engine correction impulse vector to be oriented in any direction specified from the earth. Author

N71-28986*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FLIGHT SEPARATION MECHANISMS: SPACE VEHICLE DESIGN CRITERIA
Washington Oct. 1970 39 p refs
(NASA-SP-8056) Avail: NTIS CSCL 22B

Criteria and recommended practices for the design and testing mechanisms for separating space-vehicle stages, payloads, and pods are presented. The advantages and disadvantages of various separation techniques are given and the characteristics of typical devices that have been used to effect separation are discussed. The mechanical and structural elements that maintain load-path continuity and accomplish separation are emphasized. Separation dynamics, the effects of environments and operating conditions, and methods of analyzing and testing separation mechanisms are also discussed. Author

N71-29080* Hughes Aircraft Co., Culver City, Calif.
APPARATUS FOR CHANGING THE ORIENTATION AND VELOCITY OF A SPINNING BODY TRAVERSING A PATH Patent
Harold A. Rosen and Donald D. Williams, inventors (to NASA) Issued 13 Aug. 1968 12 p Filed 30 Dec. 1959 Cl. 244-1 Sponsored by NASA
(NASA-Case-HQN-00936; US-Patent-3,398,920; US-Patent-Appl-SN-862921) Avail: US Patent Office CSCL 22B

A method and apparatus for spinning a satellite about a particular axis having a predetermined orientation with respect to the earth after the satellite has reached a selected orbit are discussed. Knowing the orientation of the satellite, the instant that the satellite has ceased to spin about the first spin axis can be determined and also the orientation of the desired new spin axis with respect to the earth's axis can be sensed. At the instant that the satellite has ceased to spin about the first axis and the desired new spin axis is simultaneously parallel to the earth's axis, the rocket case is separated from the satellite. Means is provided to spin the satellite about the new axis after separation of the rocket case from the satellite. Official Gazette of the U.S. Patent Office

N71-29101*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PAYLOAD ENCLOSURE NOISE REDUCTION
B. E. Erwin *In its* Res. Achievements Rev., Vol. 4, Rept. No. 1 Nov. 1970 p 35–40 refs (See N71-29095 16-32)
Avail: NTIS CSCL 22B

Test procedures and results are summarized in the evaluation of the noise reduction capability of helium and polyurethane foam absorptive material as a vibration isolator in the skin-stringer enclosure to minimize payload vibrations in Skylab and Apollo spacecraft. An added noise reduction of 8 to 10 dB was obtained for cylindrical structure with an internal helium environment. The noise reduction provided by polyurethane foam absorptive material was frequency dependent. Reductions of 2 to 6 dB were obtained in the frequency region of 600 to 3000 Hz. J.M.

N71-29161*# North American Rockwell Corp., Downey, Calif. Space Div.
FINAL REPORT ON A STUDY OF AUTOMATED RENDEZVOUS AND DOCKING FOR ATS 5 DESPIN, VOLUME 1
Feb. 1971 359 p
(Contract NASw-2136)
(NASA-CR-119001; SD-71-286-Vol-1) Avail: NTIS HC $6.00/MF $0.95 CSCL 22A

A study to provide a cost effective demonstration of the availability and utility of space maintenance and repair technology for despinning Applications Technology Satellite number 5 is presented. Successful accomplishment of the mission will salvage several unfulfilled objectives of the ATS-5 project and at the same time will provide operational experience with and design data on space maintenance and repair missions. Mission planning, trajectory analysis, orbital mechanics, and docking maneuvers are discussed. Author

N71-29162*# North American Rockwell Corp., Downey, Calif. Space Div.
FINAL REPORT ON A STUDY OF AUTOMATED RENDEZVOUS AND DOCKING FOR ATS 5 DESPIN, VOLUME 2: APPENDICES
Feb. 1971 265 p refs
(Contract NASw-2136)
(NASA-CR-119C02, SD-71-286-Vol-2) Avail: NTIS CSCL 22A

The requirements for a man-in-the-loop docking simulation necessary to establish pilot generated docking conditions between the Remote Maneuvering Unit (RMU) and Applications Technology Satellite (ATS) number 5 are presented. The ATS is spinning in a stable condition at 73 RPM about its longitudinal axis. The spin is undesirable because it prevents deployment of the ATS experiments. An unmanned vehicle is to be pilot controlled from the ground through a television visual system for the purpose of latching on, rigidizing, and despinning the ATS. Author

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N71-28031*# Philco-Ford Corp., Newport Beach, Calif. Space and Reentry Systems Div.
IMPERFECTION SENSITIVITY OF OPTIMIM STRUCTURAL DESIGNS FOR A MARS ENTRY CAPSULE
Gerald A. Cohen Washington NASA Jun. 1971 30 p refs
(Contract NAS1-5554-8)
(NASA-CR-1800) Avail: NTIS CSCL 22B

The imperfection sensitivity of the buckling modes of eight shell configurations, six of which correspond to otpimized capsule configurations for Mars entry, was analytically evaluated. The theory used is a generalization of the Koiter imperfection theory to include nonlinear pre-buckling states, live loading, and arbitrary imperfection shapes. Results are presented in the form of charts of snapping load as a function of root-mean-square angular imperfection amplitude. Author

N71-28056# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
INFLUENCE OF IN PLANE BOUNDARY CONDITIONS ON THE BUCKLING OF CLAMPED CONICAL SHELLS
Josef Singer, Menahem Baruch, and Jeheskel Reichenthal Sep. 1970 56 p refs
(Contract F61052-69-C-0040)
(AD-721475; TAE-93; AFOSR-TR-71-0854; SR-1) Avail: NTIS CSCL 13/13

The influence of the different in-plane boundary conditions on the buckling loads of clamped conical shells under external pressure are studied with the displacement method developed earlier by Baruch, Harari and Singer. The analysis is based on Donnell type stability equations with a membrane solution for the prebuckling stresses. Author (GRA)

N71-28067# Chesapeake Coll., Wye Mills, Md.
PROCEEDINGS OF THE FIRST THROUGH NINTH MEETINGS OF THE MECHANICAL FAILURES PREVENTION GROUP
W. T. Sawyer 1 Apr. 1971 248 p refs Meetings held Apr. 1967 – Nov. 1969
(Contract N00014-69-C-0108)
(AD-721359; MFPG-3) Avail: NTIS CSCL 20/11

The report presents collected and edited proceedings (minutes) of the first nine meetings of the Mechanical Failures Prevention Group. The reported proceedings are individually indexed. Organization, Problem definition; Agency program definition, Contractor progress reports; Bearing failures, General field survey; General field survey, Spectrographic oil analysis; Airborne failure prediction systems, Contractor progress reports; Detection, diagnosis, and prognosis of mechanical failure; Failure mechanisms as identified with helicopter transmissions; Critical failure problem areas in the aircraft gas turbine engine; and Examination of potential reduction of mechanical failure through design methodology. GRA

N71-28108*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DESIGN OF SERT 2 SPACECRAFT STRUCTURES
G. Richard Sharp Washington Jun. 1971 21 p refs
(NASA-TM-X-2301; E-6175) Avail: NTIS CSCL 22B

The SERT 2 spacecraft structures are simple, rugged, low-cost structures that can be easily changed to adapt to new components. They were designed, fabricated, and vibration tested over a very short time span with minimal stress analysis since weight was not a problem. The structures are constructed from riveted aluminum and magnesium sheet and are cylindrical semimonocoque-type structures. Simple, low-cost, easily designed and analyzed structures such as the SERT 2 structures may be used more often in the future when lower launch cost vehicles come into full use. The design constraints, design description, fabrication and handling, and shock and vibration testing of the SERT 2 structures are the subject of this report. Author

N71-28116*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
BUCKLING TESTS OF TWO INTEGRALLY STIFFENED CYLINDERS SUBJECTED TO BENDING
James Kent Anderson and James P. Peterson Washington Jun. 1971 26 p refs
(NASA-TN-D-6271; L-7528) Avail: NTIS CSCL 20K

Results of buckling tests are reported for two cylinders subjected to bending loads. The cylinders were 1.96 m (77 in.) in diameter and integrally stiffened by rings and stringers of rectangular cross section. Both cylinders buckled in a general-instability mode with considerable margin against local-instability modes which involve buckling of either the skin or the stiffening elements. Buckling occurred at loads approaching the loads predicted by the use of a small-deflection buckling theory which included the effect of stiffener eccentricity; but the quality of the cylinders was not high and the significance of the correlation obtained is clouded by the fact that actual cylinder dimensions varied considerably from point to point in the cylinders. Author

N71-28123# Chesapeake Coll., Wye Mills, Md.
GLOSSARY OF TERMS USED IN THE IDENTIFICATION AND PREDICTION OF MECHANICAL FAILURE Interim Technical Report
F. H. Schlereth 10 Jan. 1971 9 p
(Contract N00014-69-C-0108)
(AD-721354; MFPG-1) Avail: NTIS CSCL 20/11

Definitions are provided of 38 terms most frequently used in the identification and prediction of mechanical failures. Author (GRA)

N71-28124# Chesapeake Coll., Wye Mills, Md.
PROCEEDINGS OF THE MECHANICAL FAILURES PREVENTION GROUP (14th)
W. T. Sawyer 27 Feb. 1971 55 p refs Meeting held at Los Angeles, 25–26 Jan. 1971
(Contract N00014-69-C-0108)
(AD-721355; MFPG-2) Avail: NTIS CSCL 20/11

Report is given of three half-day discussions by a group of technical specialists of the topic Advances in Decision-Making Processes in Detection, Diagnosis, and Prognosis of Mechanical Failures. Emphasis in the ten prepared major talks was placed upon criteria used to make diagnostic decisions and how the results were evaluated and applied in practice. A panel session was devoted to the specific area Use of (Sonic) Vibration Sensing for Diagnostics. Brief reports of new programs or newly recognized problem areas were made. Audience discussions are reported. Author (GRA)

N71-28139# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
INFLUENCE OF IN-PLANE BOUNDARY CONDITIONS ON BUCKLING OF RING-STIFFENED CYLINDRICAL SHELLS
Tanchum Weller, Manahem Baruch, and Josef Singer Oct. 1970 61 p refs
(Contracts AF 61(052)-905; F61052-69-C-0040)
(AD-721473; TAE-101; AFOSR-TR-71-0846; SR-10) Avail: NTIS CSCL 20/11

The effect of in-plane boundary conditions on the buckling loads of simply supported ring-stiffened cylindrical shells is studied. As in the case of unstiffened shells, the weak in-plane boundary conditions SS1 and SS2 yield here critical loads about one half of the classical loads. It was observed that the SS1 critical loads are identical with the SS2 loads and the SS4 loads are almost the same as the classical SS3 loads. The combined effect of stiffener parameters and in-plane boundary conditions is studied. For internally stiffened shells the influence of in-plane boundary conditions is found to diminish with increasing values of stiffener eccentricity and area. No such effect is observed for externally stiffened shells. The buckling modes are also studied and found that they are dependent upon shell length (or Z) and upon stiffener location and parameters. Author (GRA)

N71-28161*# McDonnell-Douglas Co., St. Louis, Mo.
AN EXPERIMENTAL INVESTIGATION OF HIGH AMPLITUDE PANEL FLUTTER
H. P. Kappus, C. E. Lemley, and N. H. Zimmerman Washington NASA May 1971 129 p refs
(Contract NAS8-21250)
(NASA-CR-1837) Avail: NTIS CSCL 20K

Panel flutter tests were conducted in the 1.1 to 1.4 Mach number range for flat, rectangular, aluminum panels clamped on four sides. The panel flutter boundary was defined as a function of the primary variables, Mach number, in-plane compression load, and pressure differential across the panel. Minimum flutter onset dynamic pressures occurred between Mach 1.3 and 1.4. Panel buckling lowered the flutter onset dynamic pressure by about a factor of four over the no-load condition. A pressure differential as little as 0.1 psi raised the flutter onset dynamic pressure by 50 percent. Maximum panel surface stresses of about 11,000 psi were measured at the panel trailing edge during a deep flutter penetration run. The maximum stress conditions were maintained for over 200,000 panel oscillation cycles without panel failure. Author

N71-28171*# Stanford Univ., Calif. Dept. of Applied Mechanics.
MOTION OF A SYMMETRIC RIGID BODY UNDER THE ACTION OF A BODY-FIXED FORCE
B. S. Chia and T. R. Kane Mar. 1971 142 p refs
(Grant NGR-05-020-209)
(NASA-CR-118995; SU-TR-203) Avail: NTIS CSCL 20K

Exact dynamical and kinematical equations governing the attitude and translational motions of a six-degree-of-freedom symmetric rigid body under the action of a body-fixed force are formulated. From these equations, an analytical, but approximate, description of the behavior of the system is obtained. The validity of these predictions is established by comparing them with predictions based on digital computer solutions of the exact equations of motion. The solutions are then used to study motions of a symmetric gyrostat. Author

N71-28288# Watervliet Arsenal, N.Y.
A NEW FRACTURE TOUGHNESS TEST METHOD FOR THICK WALLED CYLINDER MATERIAL
David P. Kendall and Mosyyed A. Hussain Apr. 1971 28 p refs
(AD-721626; WVT-7122) Avail: NTIS CSCL 20/11

A new method for measuring the plane strain fracture toughness of the material from a thick-walled cylinder is presented. This method utilizes a notched, C shaped test specimen, pin loaded in tension. This specimen has the advantage of most efficiently utilizing the available material to obtain the maximum possible triaxial constraint at the crack tip. Stress intensity factor calibrations for this specimen were obtained by two independent experiments. These are a compliance test as originally proposed by Irwin and a fatigue crack growth test as suggested by James and Anderson. Very good agreement was obtained between the results of these two experiments. A stress intensity calibration for a similar geometry was also obtained using a finite element analysis and a method developed by Kobayashi to determine stress intensity factors from finite element results. The results of this method appear to be low by about 10 percent. Author (GRA)

N71-28334# Catholic Univ. of America, Washington, D.C. Inst. of Ocean Science and Engineering.
STRESSES IN SPHERICAL SHELLS DUE TO LOCAL LOADINGS
Robert Kao and Nicholas Perrone Sep. 1970 19 p refs
(Contract N00014-68-A-0506-0001; Proj. Themis)
(AD-721744; Rept-71-4) Avail: NTIS CSCL 20/11

The maximum stresses in a spherical shell are obtained which is lifted or towed by a cable or any mechanical power hoist. In view of the highly localized nature of the maximum stress induced in a spherical shell due to local loading, the nonlinear (large deflection) shallow shell theory is adopted for the analysis. A nonlinear relaxation technique in conjection with finite difference approximations is introduced for the numerical integration. Results obtained here are presented in the graphic form which may be readily used by engineers in practical design. Author (GRA)

N71-28571# Argonne National Lab., Ill.
CORRELATING THE DYNAMIC PLASTIC DEFORMATION OF A CIRCULAR CYLINDRICAL SHELL LOADED BY AN AXIALLY VARYING PRESSURE
Carl K. Youngdahl Oct. 1970 81 p refs
(Contract W-31-109-eng-38)
(ANL-7738) Avail: NTIS

To determine the localized plastic deformation of a pipe

or tube produced by a dynamic loading that exceeds the yield load only briefly, it is important to know the effect of the spatial and temporal shapes of the pressure pulse on the final deformation. This is particularly true in computer or laboratory simulations of reactor accidents, where it is impossible or impractical to reproduce the actual loading conditions. It is shown that the dynamic plastic deformation produced by an arbitrary load shape (spatial) and an arbitrary pulse shape (temporal) can be correlated by three parameters—the impulse, a load-shape parameter, and a pulse-shape parameter. These parameters are defined in terms of integrals of the pressure and are consequently insensitive to accuracies in experimental measurements. Author (NSA)

N71-28572# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.

BOUNDS TO FREQUENCIES OF UNIFORM BEAMS WITH ELASTICALLY ATTACHED MASSES

Nathan Rubinstein and James T. Stadter Aug. 1970 63 p refs
(Contract N00017-62-0604)
(AD-721334; APL-TG-1126) Avail: NTIS CSCL 20/11

The report presents upper and lower bounds to frequencies of the following uniform structures: torsion of a simply supported shaft with an elastically attached mass, bending of a simply supported beam with an elastically attached mass, bending of a fixed-free beam with elastically attached masses, and bending of a free beam with elastically attached masses. The Rayleigh-Ritz procedure was used to obtain upper bounds. Lower bounds were obtained using the method of Intermediate Problems with Special Choice. Although these problems can be solved exactly, the amount and complexity of the required computations often make this approach impractical. However, to show the effectiveness of the upper and lower bound methods, the exact frequencies are found for two of the problems. Author (GRA)

N71-28582# Chesapeake Coll., Wye Mills, Md.

PROCEEDINGS OF THE 10th MEETING OF THE MECHANICAL FAILURES PREVENTION GROUP

W. T. Sawyer, ed. 13 Apr. 1971 44 p Conf. held at Palo Alto, Calif., 21–22 Jan. 1970
(Contract N00014-69-C-0108)
(AD-721912; MFPG-4) Avail: NTIS CSCL 20/11

Report of three half-day discussions by a group of technical specialists examining the potential for detection, diagnosis, and prognosis of mechanical failure. Emphasis was placed upon the utility of vibration analysis methods in five of eleven prepared talks. Extensive audience discussions are reported. GRA

N71-28604 Princeton Univ., N.J.

STRUCTURAL RESPONSE TO BOUNDARY LAYER NOISE

Yung-Lo Lin (Ph.D. Thesis) 1969 161 p
Avail: Univ. Microfilms Order No. 70-14223

A non-linear plate theory was used to investigate the plate vibrational response to the pressure field in a supersonic turbulent boundary layer. The radiation pressure arising from the plate motion was included in the forcing field. The displacement of the plate was expanded in terms of the modal functions of the plate and the Galerkin's procedure was used to reduce the partial stochastic differential equation into a set of nonlinear ordinary stochastic differential equations in time. Both frequency domain and time domain analyses were used to obtain some useful statistical quantities of the plate response. In the case when the power spectral density function of the flutusting pressure field can be empirically approximated by a ratio of two rational polynomials in frequency, numerical simulation of the pressure field and the plate random vibratory response were shown to be practical and feasible. Dissert. Abstr.

N71-28605# Columbia Univ., New York.

DETERMINATION OF KINEMATIC CHARACTERISTICS OF MECHANISMS FROM THE STRUCTURAL ANALYSIS OF KINEMATIC CHAINS. COMBINATORY TOPOLOGICAL ANALYSIS OF KINEMATIC CHAINS AND MECHANISMS

Final Report, 29 Jan. 1964–28 Jan. 1971
F. Freudenstein 25 Feb. 1971 8 p refs
(Contract DA-31-124-ARO(D)-178)
(AD-721367; AROD-4530.7-E) Avail: NTIS CSCL 20/11

The major topics of research have been the following: (a) Mathematical representation of the kinematic structure of mechanisms and kinematic chains, as an abstract, linear graph. (b) Enumeration and classification of plane and spatial mechanisms according to kinematic structure and freedom. (c) Computer-aided kinematic analysis of planar mechanical systems. (d) Investigation of degree of attainable automation of the kinematic and dynamic analysis of one representative class of mechanical systems. The principal problem has been the development of a mathematical analysis of the kinematic structure of mechanisms (and kinematic chains) and its application to the development of methods for the computer-aided kinematic analysis of mechanical systems. Author (GRA)

N71-28606# California Univ., Berkeley. Structural Engineering Lab.

ELASTIC-PLASTIC ANALYSIS OF AXISYMMETRIC SOLIDS USING ISOPARAMETRIC FINITE ELEMENTS

P. K. Larsen and E. P. Popov Jan. 1971 53 p refs
(Contract DAHC04-69-C-0037)
(AD-721317; UCSEM-71-2; AROD-82845-A) Avail: NTIS CSCL 13/13

Application of special isoparametric finite elements is presented for elastic-plastic analysis of shells of revolution. General isoparametric elements are selected which in the form of a layered system are capable of representing a solid of revolution. The customary Kirchhoff-Love hypothesis is not invoked and the solutions therefore apply both to thin and thick shells of revolution. Sharp discontinuities in geometry, circumferential ribs and/or grooves, as well as cellular walls, may be studied. A special feature is the development of an element permitting sliding at the element interfaces with or without friction. The illustrative examples include a pressure vessel with a circumferential crack in the wall thickness, a circular plate consisting of two discs which can slide along their interface, and shrink-fit of two thick-walled circular cylinders. The solutions are limited to axially symmetric problems. Flow theory of plasticity is used in the inelastic range. GRA

N71-28633 Michigan Univ., Ann Arbor.

SOME PROBLEMS IN THE PENETRATION OF A WEDGE INTO A NON-ISOTROPIC BRITTLE MATERIAL

Rafael Benjumea Cabeza De Vaca (Ph.D. Thesis) 1969 224 p
Avail: Univ. Microfilms Order No. 70-14474

The fracture mechanism that takes place during the penetration of a rigid wedge into an elastic, brittle, non-isotropic material is discussed. Two distinct processes occuring during penetration are crushing, followed by the formation of a chip. The main concern of this investigation is the chip formation process itself. Based on simplifying assumptions, mainly with regard to the stress field, a theory is presented which explains some important, experimentally observed, anisotropic effects during the penetration of the wedge into the material. A more basic understanding of the chip formation process requires the study of the precise stress field in the brittle material around the wedge. Dissert. Abstr.

N71-28634*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

STAGING LOADS SPACE VEHICLE DESIGN CRITERIA

R. L. Goldman Washington Feb. 1969 30 p refs
(NASA-SP-8022) Avail: NTIS CSCL 22B

The loads that result from the staging operation are discussed. Criteria are formulated and practices are recommended to ensure

that such loads are accounted for in the design of space vehicle structures. Staging loads also account for significant local influences, and are often the critical design condition for equipment and equipment-support structures located near the separation plane. The severity of staging loads depends upon the type of staging system, the dynamic characteristics of the space vehicle, and the staging environment. When designing for staging loads, the potential sources of these loads are assessed; the structural responses and stresses are then determined by rational multidegree-of-freedom analysis; and where warranted, tests are conducted to demonstrate structural adequacy. Author

N71-28844 Illinois Univ., Urbana.
INFLUENCE OF GEOMETRICAL AND TOPOLOGICAL CONFIGURATION OF THE WEIGHT OF SIMPLY SUPPORTED PLANE TRUSSES
Harry Leonard Jones (Ph.D. Thesis) 1969 156 p
Avail: Univ. Microfilms Order No. 70-13369

A general method is developed for studying the influence of geometrical and topological configuration on the weight of simply supported plane trusses. Though the method is applicable to any truss structure, it is intended specifically to treat trusses that may be used in building and bridge construction. Therefore, provisions have been included to restrict the general shape or outline of the truss, and to consider loads acting on the joints of the truss whose magnitudes and directions may vary with the position of the joints. Multiple loading conditions are also considered. The cross sectional areas of the members of the truss are selected on the basis of allowable stresses, and the allowable compressive stress is determined by stability considerations. In order to isolate the influence of geometrical and topological configuration from other factors affecting the weight of a truss, a set of comparable structures is defined. Dissert. Abstr.

N71-28847 Michigan Univ., Ann Arbor.
ANALYSIS OF THE EFFECT OF SHEAR DEFORMATION ON THE SINGULAR SOLUTION OF SPHERICAL SHELLS USING THE METHOD OF MATCHED ASYMPTOTIC EXPANSIONS
James Richard Osborn, Jr. (Ph.D. Thesis) 1969 144 p
Avail: Univ. Microfilms Order No. 70-14610

The effect of shear deformation on the singular solutions of a thin, nonshallow spherical shell using a linear shear deformation theory is discussed. The shell equilibrium equations are expressed in terms of the deformations of the midsurface of the shell. Two boundary value problems, which include concentrated loads at the apex of the shell, are formulated. The first problem considers a vertical load at the apex, and the second considers a tangent load and couple at the apex. The method of matched asymptotic expansions was used to obtain the solution for these two problems in the form of an asymptotic expansion in a small parameter, sigma. The parameter sigma is proportional to the square rot of the ratio of the shell thickness to radius of curvature. Dissert. Abstr.

N71-28886# Northwestern Univ., Evanston, Ill. Dept. of Civil Engineering.
DYNAMICS OF SHELLS Scientific Interim Report
G. Herrman 25 Jan. 1971 21 p refs Presented at the Intern. Colloq. on Progr. of Shell Struct. in the Last 10 Years and Its Future Develop., Madrid, Sep. - Oct. 1969
(Grant AF-AFOSR-0100-67)
(AD-721480; AFOSR-TR-71-0833) Avail: NTIS CSCL 13/13

Recent analytical and experimental research activities in the area of dynamic behavior of thin elastic shells at the Structural Mechanics Laboratory of Northwestern University are reviewed. These activities fall within the following three groups: analytical and experimental studies of frequency spectra and mode shapes of cylindrical shells subjected to initial mechanical stresses and non-uniform heating; analytical and experimental studies of impact loading of cylindrical shells and rings; and dynamic interaction of cylindrical shells and a surrounding fluid. Author (GRA)

N71-28894# Polytechnic Inst. of Brooklyn, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.
ON INFINITESIMAL STABILITY AND INSTABILITY OF PENDULUM TYPE OSCILLATIONS
Morris Morduchow Feb. 1971 23 p refs
(Contract N00014-67-A-0438-0006)
(AD-721704; PIBAL-71-5) Avail: NTIS CSCL 20/11

For the pendulum type of oscillations governed by the equation $\ddot{x} + p(x) = 0$, with p(x) an odd function, it is shown that according to the linearized disturbance equation, stability is predicted if and only if $dT/d\alpha = 0$, where T is the period and alpha is the amplitude of the nonlinear steady-state oscillations. From this it follows that for a given nonlinear function, infinitesimal stability can at most be predicted only for certain discrete values of alpha. It is shown analytically that for a simple pendulum, a power-law spring and a cubic hard or soft spring, the oscillations are infinitesimally unstable for all alpha. It is further shown, however, that particular cases of nonlinear restoring forces do exist for which infinitesimal stability is predicted for certain alphas, in contrast to the actual Liapunov instability in these cases. Author (GRA)

N71-28895# Catholic Univ. of America, Washington, D.C. School of Engineering and Architecture.
DEVELOPMENT AND APPLICATION OF METHODS OF EXPERIMENTAL MECHANICS. EXPERIMENTAL ANALYSIS OF STRESSES IN A BUOY-CABLE SYSTEM USING A BIREFRINGENT FLUID
A. J. Durelli and J. A. Clark Feb. 1971 31 p refs
(Contracts N00014-67-A-0377-0011; N00014-68-A-0506; Proj. Themis)
(AD-721391; Rept-26) Avail: NTIS CSCL 13/9

An extension of the method of photoviscous analysis is presented which permits quantitative studies of strains associated with steady state vibrations of immersed structures. Strains can be determined both in the vibrating structure and in the surrounding fluid. The method is applied in an investigation of one form of behavior of buoy-cable systems loaded by the action of surface waves. Procedures are illustrated for evaluating directly from the strain data parameters useful to the buoy-cable system designer. The analysis performed is two-dimensional. The cable is modeled by a soft rubber strip, and the buoy by a round can floating on the surface of a birefringent fluid. A payload is simulated by a weight attached to the lower end of the strip. Waves of controllable frequency are produced by a device actuated by a shaker. Strains in the fluid and in the strip are determined from isochromatic and isoclinic data and the possible extension of the experimental results obtained to prototypes by means of scaling laws is suggested. Author (GRA)

N71-28717# Brown Univ., Providence, R.I.
ASYMPTOTIC STABILITY AND INSTABILITY CRITERIA FOR SOME ELASTIC SYSTEMS BY LIAPUNOV'S DIRECT METHOD
R. H. Plaut 1 Apr. 1971 15 p refs
(Contract N00014-67-A-0191-0009)
(AD-721384) Avail: NTIS CSCL 20/11

Sufficient conditions for asymptotic stability and instability are derived here for some elastic systems with dissipation. The systems are assumed to be governed by autonomous partial differential equations which may be non-self-adjoint. The method of analysis is Liapunovs direct method. Author (GRA)

N71-28834 Michigan Univ., Ann Arbor.
A PROCEDURE FOR THE DYNAMIC ANALYSIS OF THIN WALLED CYLINDRICAL LIQUID STORAGE TANK SUBJECTED TO LATERAL GROUND MOTIONS

Normal Wayne Edwards (Ph.D. Thesis) 1969 174 p
Avail: Univ. Microfilms Order No. 70-14507

Dynamic responses of elastic, thin walled, cylindrical, flat bottom, liquid storage tanks subjected to arbitrary lateral ground motions are investigated. Structural damage to oil storage tanks of this type caused by lateral earthquake motion as recently (1964) observed in Alaska demonstrates the need for such studies. A survey of the literature reveals that the technique presently available to the practicing engineer for evaluating the dynamic response of this type tank utilizes a lumped mass analog. The derivations of some of these analogs which assume rigid tank walls are presented. The advantage of the lumped mass analog is that its response to arbitrary lateral ground motion is relatively easy to calculate. The disadvantage is that the base shear and overturning moment are the only two quantities which are modeled. Dissert. Abstr.

N71-29045*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

QUALIFICATION TESTING: SPACE VEHICLE DESIGN CRITERIA

Washington May 1970 30 p refs
(NASA-SP-8044) Avail: NTIS

Qualification tests are conducted on flight-quality components, subsystems, and systems to demonstrate that structural design requirements have been achieved. In these tests, critical portions of the design loadings are simulated and the performance of the hardware is then compared with previously established accept-reject criteria based on mission requirements. The test loadings and durations are designed to give a high level of confidence that, if test specimens perform acceptably, similar items manufactured under similar conditions can survive the expected service environments. These loads and durations usually exceed expected flight loads and functions. Author

N71-29088*# Southampton Univ., (England). Inst. of Sound and Vibration.

MODEL STUDIES OF HELMHOLTZ RESONANCES IN ROOMS WITH WINDOWS AND DOORWAYS

Gary Koopmann and Howard Pollard Washington NASA Jun. 1971 31 p refs
(Grant NGR-52-025-002)
(NASA-CR-1777) Avail: NTIS CSCL 13M

The cavity resonance of a room enclosed by large windows and open doors can be set into motion if the windows should suddenly be subjected to an impulsive load, say, a sonic boom. To determine the conditions and possible damaging consequencies of such a resonance, a study has been conducted which utilizes the method of expressing the windows, air and common doorway to two typically joined rooms in terms of equivalent lumped elements. The resultant dynamic system is treated as a series of coupled Helmholtz resonators and has as its mathematical description a set of coupled, second order differential equations. Solutions to these equations have been generated on an analog computer for several types of impulsive loading conditions. Experiments were also performed on actual scaled models to guide the computer study. Results describe the conditions for which a maximum of coupling occurs between the window and room resonances. Author

N71-29095*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

RESEARCH ACHIEVEMENTS REVIEW. VOLUME 4: REPORT NO. 1: STRUCTURES RESEARCH AT MSFC

Nov. 1970 59 p refs
(NASA-TM-X-64528) Avail: NTIS CSCL 22B

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N71-29096*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

STATISTICAL DETERMINATION OF SAFETY FACTOR REQUIREMENTS FOR UNTESTED STRUCTURES FROM SATURN 5 TEST DATA

Jerrell M. Thomas *In its* Res. Achievements Rev., Vol. 14, Rept. No. 1 Nov. 1970 p 1–4 (See N71-29095 16-32)
Avail: NTIS CSCL 22B

A possible method is illustrated for determinig what safety factor is required to provide reliable structures without testing. The distribution of failure frequency about a mean value (near the predicted value) is approximately normal for Saturn 5 structures. The task of determining the safety factor for untested structures which gives the same probability of success as that obtained with tested structures in analyzed. Statistical properties of the Saturn 5 test are determined and a normal distribution curve is constructed. A percentage of the predicted failure load is determined for which a selected probability exists that the failure load of the article under consideration will exceed. From that percentage, the required safety factor is determined to assure that the structural article will not fail at less than the ultimate load. J.M.

N71-29097*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

MODAL ANALYSIS OF STRUCTURES BY AN ITERATIVE RAYLEIGH-RITZ TECHNIQUE

John R. Admire *In its* Res. Achievements Rev., Vol. 4, Rept. No. 1 Nov. 1970 p 5–12 refs (See N71-29095 16-32)
Avail: NTIS CSCL 22B

A method of modal analysis of structures is presented. The method is based on repeated applications of the Rayleigh-Ritz technique using improved coordinate vectors for each iteration. This procedure is convergent, since each application of the Rayleigh-Ritz technique yields a better approximation of the modal properties of the structure. Numerical examples are used to demonstrate the rapid convergence of the method. Author

N71-29098*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

FLOW INDUCED VIBRATIONS IN METAL BELLOWS

H. J. Bandgaen *In its* Res. Achievements Rev., Vol. 4, Rept. No. 1 Nov. 1970 p 13–21 refs Prepared in conjunction with Southwest Res. Inst. (See N71-29095 16-32)
(Contract NAS8-21133)
Avail: NTIS CSCL 20K

The results of an experimental and analytical study of flow induced vibration of metal bellows are summarized. A semiempirical method of estimating the flow induced dynamic stresses in a bellows for a given set of flow conditions was formulated. Design methods for eliminating or minimizing the effects of flow induced vibration in bellows systems were developed and experimentally verified. The criteria presented were used to assess all of the metal bellows in the Saturn/Apollo launch vehicle system to determine

if flow induced vibration problems existed. Corrective action was implemented where necessary by the installation of flow liners or the addition of damping to the bellows system. Author

N71-29089*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

NASTRAN, NASA'S GENERAL PURPOSE STRUCTURAL ANALYSIS PROGRAM

R. L. McComas *In its* Res. Achievements Rev., Vol. 4, Rept. No. 1 Nov. 1970 p 23–26 (See N71-29095 16-32)

Avail: NTIS CSCL 22B

Only the finite elements are included in the NASTRAN computer program to deal with one- and two-dimensional elastic relationships such as beams, plates, and axisymmetric shells. The single FORTRAN 4 program with five static analysis and seven dynamic analysis formats is discussed. The program has a modular separation of functional capabilities organized under an efficient problem-independent executive system which separates system functions from problem solution functions. It establishes and controls the sequence of module execution according to options specified by the user; it establishes and communicates values of parameters for each module; it allocates files for all data blocks generated during program execution and performs input/output to auxiliary files for each module; and it maintains a full restart capability for restoring a program execution after either a scheduled or unscheduled interruption. The structural modules, matrix operations, utility modules, and user modules are cited. The Theoretical Manual, the User's Manual, and the Programmer's Manual are also summarized. J.M.

N71-29100*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

SKYLAB DOCKING RESPONSE ANALYSIS

W. B. Holland *In its* Res. Achievements Rev., Vol. 4, Report No. 1 Nov. 1970 p 27–34 refs (See N71-29095 16-32)

Avail: NTIS CSCL 22B

The salient features of the mathematical formulation and digital algorithm developed for the Skylab docking response analysis are presented. The mathematical model considers the docking bodies to be in proximity such that collision is imminent. The coupling of the docking mechanism and the elastic responses of the vehicles are included. The Apollo probe/drogue docking system is considered. Author

N71-29102*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

S-2 STAGE VIBRATION TESTING AND ANALYSIS FOR THE POGO PHENOMENA

H. M. Lee *In its* Res. Achievements Rev., Vol. 4, Report No. 1 Nov. 1970 p 41–49 ref (See N71-29095 16-32)

Avail: NTIS CSCL 22B

Details of the extensive experimental research program performed on the S-2 stage vehicle in conjunction with a definitive math model development utilizing the test information are presented. The tests were conducted using a shortened S-2 stage to determine dynamic characteristics of the thrust structure/center engine crossbeam/liquid hydroelastic system. The data were used as direct input in developing the math model. Comparisons between results obtained from the empirical model and tests are made; these show excellent correlation in frequency, response, and mass characteristics. Also, comparisons between flight data and the calculated overall vehicle model parameters are made to further verify the adequacy of the structural model. Author

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N71-28042*# Rocketdyne, Canoga Park, Calif.

PROTECTIVE COATING SYSTEM FOR A REGENERATIVELY COOLED THRUST CHAMBER Final Report, 1 Feb. 1968–31 Dec. 1970

H. W. Carpenter Jun. 1971 120 p refs

(Contract NAS3-11187)

(NASA-CR-72855; R-8406) Avail: NTIS CSCL 20M

A slurry-applied, heat-barrier coating was developed and evaluated in a planned sequence of arc-plasma jet and rocket motor tests of increasing complexity and severity. The coating, a phosphate-bonded zirconia system, was designed to reduce heat flux through the walls of thrust chambers of liquid hydrogen/liquid oxygen fueled rocket engines from 50 to 20 Btu/sq in/sec and to withstand a 4000 F surface temperature, severe temperature gradients (as much as 1,000,000 F/inch thickness), and many thermal cycles. Rocket motor tests included: chamber pressure of 140 to 575 psia, mixture ratio of 6 to 7, number of cycles on a given specimen of 1 to 3, and heat flux through the coated specimens of 5.0 to 19.2 Btu/sq in/sec. Test specimens consisted of two types: water-cooled, coated single tubes positioned perpendicular to the combustion gas (that actually formed the throat of the rocket motor), and a water-cooled, coated tubular wall in a two-dimensional throat segment. Author

N71-28074*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

AN EXPERIMENTAL INVESTIGATION OF THREE BALLOON-TYPE ENCLOSURES FOR THERMAL CONTROL OF SATELLITES

George E. Sweet Washington Jun. 1971 47 p refs

(NASA-TN-D-6224; L-7015) Avail: NTIS CSCL 20M

Thermal-vacuum tests of three balloon-type thermal-control enclosures for satellites indicate that payload temperature uniformity for these designs would be one to two orders of magnitude better than that for an unshielded satellite. Results indicate that temperature uniformities of 5 to 10 K are feasible for a small, solid, nonconducting payload located near the center of the enclosure. Measured results indicate that the temperature uniformity of surfaces near the center of the enclosure is relatively insensitive to satellite orientation, changes in payload heat dissipation, and the presence of an enclosure viewpoint opening. Balloon interiors of high reflectance provided the most uniform temperatures for an enclosed payload and the least uniform balloon temperatures. Author

N71-28107# Oak Ridge National Lab., Tenn. Instrumentation and Controls Div.

THERMAL RADIATION TRANSFER OF AFTERHEAT IN MSBR HEAT EXCHANGERS

J. R. Tallackson Mar. 1971 108 p refs

(Contract W-7405-eng-26)

(ORNL-TM-3145) Avail: NTIS

A fraction, estimated to be 40%, of the heat-producing noble metal fission products is expected to deposit on the metal surfaces within the primary fuel salt loop in a molten salt reactor. Virtually all of this 40% will be in the heat exchangers. The normal means of afterheat removal is to continue to circulate the primary and secondary salts. In circumstances where the heat exchangers are quickly drained of both primary and secondary salts, the primary system must accommodate high temperatures without compromising containment. Steady state temperature calculations, based on radiative heat transfer in MSBR primary heat exchangers, are presented. Several sizes with ratings from 94 MW to 583 MW and all with the same general configuration were considered. Radial temperature profiles were computed for afterheat rates corresponding to elapsed times from 100 sec to 11 days after reactor shutdown. The effect of the emissivity of the internal radiating surfaces in the heat exchangers was included. Author (NSA)

N71-28137 National Lending Library for Science and Technology, Boston Spa (England).
HEAT TRANSFER AND PRESSURE LOSS IN HEAT EXCHANGERS WITH ANNULAR DISK BAFFLES [TEPLOOBMEN I POTERI DAVLENIYA V TEPLOOBMENNIKAKH S PEREGORODKAMI TIPA DISK-KOLTSO-]
V. A. Shvarts et al Dec. 1970 7 p refs Transl. into ENGLISH from Energomashinostr. (Moscow), v. 14, no. 4, 1968 p 23–24
(NLL-RTS-5988) Avail: Natl. Lending Library, Boston Spa, Engl.: £0.50; 2 NLL photocopy coupons

Two standard oil coolers for turbine installations were tested over a wide range of Re numbers. The coolers are similar tubular heat exchangers with disk-ring type barriers which ensure oil flows across the tubes from the periphery to the center and back. One cooler has the cooling surface larger by 93.7 sq m. Tests were made with light turbine oil and water. The heat transfer data and pressure drop data were plotted on log-log graphs and came out a straight line and a curve, respectively. Equations are presented for the relationships. N.E.N.

N71-28200# Technische Hogeschool, Delft (Netherlands). Afdeling der Technische Natuurkunde.
HEAT TRANSFER AND EVAPORATION BY FREE CONVECTION ALONG A VERTICAL CYLINDER [WARMTEOVERDRACHT EN VERDAMPING DOOR VRIJE CONVECTIE LANGS EEN VERTICALE CYLINDER]
Frederick Alexander Bottemanne (Ph.D. Thesis) Jun. 1970 95 p refs In DUTCH; ENGLISH summary
Avail: NTIS

Measurements of stationary heat and mass transfer by free convection along a vertical cylinder are described. The experiment is based on the classical problem of transfer from a vertical flat plate. The validity of the boundary layer theory for isothermal mass transfer as well as for simultaneous heat and mass transfer is established. ESRO

N71-28213# Technische Hogeschool, Delft (Netherlands). Afdeling der Technische Natuurkunde.
PHYSICAL ASPECTS OF TURBULENT LIQUID-LIQUID DISPERSIONS [PHYSISCHE ASPECTEN VAN TURBULENTE VLOEISTOF-VLOEISTOF DISPERSIES]
Jan Willem Van Heuven (Ph.D. Thesis) 1969 124 p refs In DUTCH; ENGLISH summary
Avail: NTIS

Several aspects of immiscible liquid-liquid dispersions as produced in a stirrer equipped vessel are investigated, such as the power consumption stirrer, the drop size distribution in the dispersion, the minimal stirrer speed for complete dispersion, the coalescence rate of dispersion droplets, and the mass transfer coefficients in the continuous and dispersed phases. ESRO

N71-28331# National Academy of Sciences-National Research Council, Washington, D.C. Committee on Hazardous Materials.
FIRE HAZARD CLASSIFICATION OF CHEMICAL VAPORS RELATIVE TO EXPLOSION-PROOF ELECTRICAL EQUIPMENT Progress Report
H. Carhart 10 Feb. 1970 40 p refs
(Contract TCG-15559-A; DOT-CG-713192)
(AD-720294) Avail: NTIS CSCL 13/12

A detailed study has been made by the Electrical Hazards Panel of the Committee on Hazardous Materials to determine the feasibility of classifying some 200 chemicals of commerce according to the classifications given in the National Electric Code, NEC 500, by using a scheme based entirely on available physical and flammability properties only. The system would eliminate the present laborious process of actually testing the piece of electrical equipment in the vapors of the particular chemical of concern. Author (GRA)

N71-28396 National Lending Library for Science and Technology, Boston Spa (England).
THE BOILING POINTS OF SUPERHEATED LIQUIDS
V. F. Prisnyakov 2 Jul. 1970 6 p refs Transl. into ENGLISH from Teplofiz. Vysokikh Temperatur, Akad. Nauk SSSR (Moscow), v. 8, no. 2, 1970 p 451–454
(NLL-Risley-Trans-1987-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Experimental data on the superheating of sodium and potassium were reassessed. The data were fitted to curves, and a definite family of curves was obtained which indicates that the boiling point varies with the degree of surface roughness. An analogous family of curves for water is discussed. N.E.N.

N71-28561# Naval Ordnance Lab., White Oak, Md.
COMPARISON OF CONSTANT CURRENT AND CAPACITOR DISCHARGE IGNITION OF NORMAL LEAD STYPHNATE
Howard S. Leopold 2 Mar. 1971 27 p refs
(AD-721695; NOLTR-70-236) Avail: NTIS CSCL 19/1

A comparison was made of constant current and capacitor discharge ignition of normal lead styphnate in the time regime typically employed for firing initiators by each type of signal. The loading pressure was varied from 2,500 to 60,000 psi. For the regimes studied, as the explosive loading pressure was increased, constant current activation gave longer ignition times but capacitor discharge firing gave shorter ignition times. The energy requirement for ignition increased with loading pressure for constant current ignition, and was constant for capacitor discharge ignition. Author (GRA)

N71-28573 Wisconsin Univ., Madison.
MONOCHROMATIC UV ABSORBANCE HISTORIES OF UNBURNED GASES IN A SPARK IGNITION ENGINE
Ather Abdul Quader (Ph.D. Thesis) 1969 331 p
Avail: Univ. Microfilms Order No. 70-3670

The theory and development of a technique to measure monochromatic ultraviolet (UV) absorption histories in the end gas of a spark ignition engine is presented. The UV absorption and pressure histories in a CFR engine operated under motored, autoignited, and spark ignited (fired) conditions were recorded continuously in a multichannel tape recorder. The end gas temperature histories were also measured using the null method of infrared radiation. Normal heptane, hexane, cyclohexane, ethane, isooctane, and blends of 75 octane number (ON), 50 ON, and 25 ON primary reference fuels (PRF) were studied. The effect of selected engine variables and fuel type on the absorbance histories of the end gas were investigated over a range of operating conditions from no knock to heavy knock and autoignition. Dissert. Abstr.

N71-28574 Wisconsin Univ., Madison.
DETONATIONS IN DECANE OXYGEN AEROSOLS
Frank John Steffes (Ph.D. Thesis) 1970 107 p
Avail: Univ. Microfilms Order No. 70-11880

A study of detonation phenomena in a heterogeneous system composed of decane droplets in oxygen atmospheres has been made. Detonation velocities and pressures were measured, and streak self-light photographs of the process were taken. For aerosols whose mean droplet diameters were 0(2 microns), as generated by an ultrasonic nebulizer, the lower limit of detonability in long tubes was found to occur at an equivalence ratio of 0.15 when the pressure was one atmosphere and the ignition energy was two joules (delivered by an exploding wire). The upper limit of detonability could not be determined because equivalence ratios less than 0.7 could not be generated with the nebulizer. Wave velocities have been determined by measuring elapsed times between fixed stations; the sensing devices are coaxial pin transducers. The variation of wave velocity with equivalence ratio (0.15 to 0.7), tube diameter (2.22, 1.42, 0.82, 0.49 cm i.d.), and tube length are presented. Dissert. Abstr.

N71-28795*# Aerotherm Corp., Mountain View, Calif.
DEMONSTRATION OF THE RANGE OVER WHICH THE LANGLEY RESEARCH CENTER DIGITAL COMPUTER CHARRING ABLATION PROGRAM (CHAP) CAN BE USED WITH CONFIDENCE. TASK 1: COLLECTION OF PROPERTIES DATA AND ABLATION TEST DATA FOR THREE CHARRING MATERIALS, AND RESULTS OF QUALIFYING CALCULATIONS WITH CHAP Final Report
Carl B. Moyer, Kenneth A. Green, and Mitchell R. Wood Dec. 1970 127 p ref
(Contract NAS1-10136)
(NASA-CR-111834; Rept-70-25) Avail: NTIS CSCL 20M

Thermophysical and thermochemical material property data and ablation test data have been compiled for three charring ablators: low-density nylon phenolic, the Apollo heat shield material, and a filled silicone elastomer. These data are representative of the published data on these materials. Comments are made on the accuracy and credibility of these data. Also, the analysis of the ablation test data, with the NASA Langley Research Center Charring Ablation Program (CHAP), is discussed. Author

N71-28836 Illinois Univ., Urbana.
TIME DEPENDENT THERMOCONVECTIVE INSTABILITY
Philip Martin Gresho (Ph.D. Thesis) 1969 459 p
Avail: Univ. Microfilms Order No. 70-13328

A system consisting of a thin, horizontal layer of Newtonian fluid bounded above and below by rigid, conducting surfaces, but unbounded laterally; the fluid uniformly heated (cooled) at the lower (upper) surface, and the heating rate being measured by the Rayleigh number is described. The problem is the mathematical description of the behavior of this system for several particular experiments which are either of a transient nature or are time-dependent owing to the external manipulation of a relevant parameter. In all cases, emphasis is placed on the time-dependence of the solution. The approximation solution makes use of Galerkin's method with undetermined, time-dependent amplitude coefficients. This allows the reduction of the system of governing partial differential equations to one of first-order, ordinary differential equations in time (for the amplitude coefficients). The systems are analyzed first, in the linearized approximation in order to determine stability limits, and subsequently using the full, nonlinear equations (specialized to two-dimensional roll cells) in order to predict finite-amplitude effects such as heat transfer rate and flow magnitude. Dissert. Abstr.

N71-28852* North American Aviation, Inc., El Segundo, Calif.
METHOD AND CONSTRUCTION FOR PROTECTING HEAT SENSITIVE BODIES FROM THERMAL RADIATION AND CONVECTIVE HEAT Patent
Casimir F. Kubik, inventor (to NASA) Issued 18 Oct. 1966 5 p Filed 1 Jul. 1964 Cl. 60-266 Sponsored by NASA
(NASA-Case-XNP-01310; US-Patent-3,279,193; US-Patent-Appl-SN-379771) Avail: US Patent Office CSCL 20M

A method and construction of using an opaque fluid, such as smoke, as a protective covering for the heat sensitive bodies or components is described. The smoke is positioned between the body and the heat source, to serve as a barrier that primarily blocks and reflects the radiations so that they do not reach the body. Also, the smoke is continually replenished to expel previously provided smoke that has been heated up to primarily prevent convective heat transfer to the body. In the broadest aspects of the invention, an opaque highly reflective smoke distributed to cover a city could conceivably be used to protect the city from the thermal radiation of an atomic bomb. Or in its more narrow aspects, the opaque smoke can be used to protect heat sensitive components of a rocket where weight is an important consideration. Official Gazette of the U.S. Patent Office

N71-28862*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
CONVECTIVE HEAT-TRANSFER RATES ON A BLUNTED 110 DEG CONE WITH HEMISPHERICAL AFTERBODY AT HYPERSONIC SPEEDS
David A. Stewart Washington Jul. 1971 22 p refs
(NASA-TN-D-6433; A-3970) Avail: NTIS CSCL 20M

Heat-transfer rates were measured on a one-sixth scale model of a blunted 55 deg half-angle cone with spherical segment nose cap and hemispherical afterbody. The investigation was conducted in a shock tunnel and free-flight facility at Mach numbers of 7 and 15, Reynolds numbers of 300,000, 100,000 and 15,500, and angles of attack from 0 deg to 25 deg. From existing theories of inviscid flow, which include the bow-wave shape and the large pressure gradients near the sharp corner, the surface heating-rate distribution is predicted at alpha = 0 deg. High-transfer rates occurred near the sharp corner of the model at all angles of attack because of local pressure gradients. In general, the pattern of forebody heating-rate distribution with increased angle of attack was higher to windward and lower to leeward. The heating rates on the hemispherical afterbody did not exceed 20 percent of the reference stagnation value. An order-of-magnitude increase in Reynolds number influence heating only near the corner of the forebody, where local values decreased from 60 to 30 percent as the angle of attack was increased from alpha = 0 deg to 10 deg. Bow-wave profiles were taken during the heat-transfer tests at angles of attack from 0 deg to 25 deg. An observed inflection in the bow-wave at alpha = 0 deg and alpha = 10 deg is attributed to three-dimensional effects in the inviscid flow; in the present investigation, this injection had no discernible effect on surface heating. Author

N71-28882* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
CYROGENIC THERMAL INSULATION Patent
Robert L. Middleton, John T. Schell, and James M. Stuckey, inventors (to NASA) Issued 30 Jan. 1968 4 p Filed 17 Jun. 1966 Cl. 62-45
(NASA-Case-XMF-05046; US-Patent-3,365,897; US-Patent-Appl-SN-559350) Avail: US Patent Office CSCL 20M

A thermal insulation for insulating containers of cryogenic fluids, and particularly for insulating liquid hydrogen fuel tanks of space vehicles is discussed. A layer of insulation having a honeycomb core is bonded to the cryogenic fluid container with the cells of the honeycomb core being sealed airtight. When an extremely cold liquid, such as liquid hydrogen, is introduced into the container the air and other gases within the airtight cells are solidified and a cryo-vacuum is produced in each cell so that the honeycomb layer provides the effectiveness of vacuum insulation. A second honeycomb layer may be applied over the first layer with the core of the second layer being filled with pressurized helium gas to purge the second insulation layer of air and prevent the entry of atmospheric air into the insulation through punctures or other openings in the second insulation layer. Official Gazette of the U.S. Patent Office

N71-28903* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SOLID STATE THERMAL CONTROL POLYMER COATING Patent
George F. Pezdirtz, inventor (to NASA) Issued 5 Nov. 1968 6 p Filed 28 Mar. 1966 Cl. 244-1
(NASA-Case-XLA-01745; US-Patent-3,409,247; US-Patent-Appl-SN-538907) Avail: US Patent Office CSCL 11C

The thermal control of space vehicles, with a solid state polymer with thermal properties for achieving thermal balance for a space vehicle when exposed to an ambient environment of variable electromagnetic radiation is discussed. The polymer employed must be a highly crystalline polymer to provide numerous small crystallites in the opaque state and thereby permit a minimum thickness being used for the thermal control coating. High molecular

weight polymers treated in this manner have the inherent physical property characteristic of being opaque below a predetermined temperature and becoming transparent above this temperature. This critical temperature, or design temperature, is unique with each polymer and is a function of its molecular structure and, within limits, its molecular weight. Thus, by selecting a polymer having a normal melting temperature in the design temperature range of that desired for a particular spacecraft mission, the thermal control of the spacecraft at approximately this temperature level may be obtained by a minimum thickness coating of the specific polymer selected on the spacecraft.

Official Gazette of the U.S. Patent Office

N71-28904*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

OXIDATION SCREENING AT 1204 C (2200 F) OF CANDIDATE ALLOYS FOR THE SPACE SHUTTLE THERMAL PROTECTION SYSTEM

W. A. Sanders and C. A. Barrett 1971 30 p refs Proposed for presentation at Space Shuttle Mater. Conf., Madison, Ala., 5–7 Oct. 1971; sponsored by the Soc. of Aerospace Mater. and Process Engr.

(NASA-TM-X-67884; E-6404) Avail: NTIS CSCL 20M

The oxidation resistance of fifteen alloys was evaluated under some of the environmental conditions that might be encountered by the shuttle thermal protection system. The alloys included nickel-, iron-, and cobalt-base wrought alloys. Specimens were self-resistively heated to 1204 C (2200 F) in a 10 torr still air environment for 100 thirty-minute cycles. Specimen weight, thickness and microstructural changes were noted and surface scales were identified by room temperature X-ray diffraction. Based on these observations, the behavior of the alloys was evaluated in terms of overall amount of metal consumption due to oxide formation and relative tendency toward oxide spalling and scale vaporization.

Author

N71-28910 Illinois Univ., Urbana.

COMBUSTION IN PRE-MIXED GASEOUS SYSTEMS IN STAGNATION FLOW

Howard Wayne Smith (Ph.D. Thesis) 1969 120 p

Avail: Univ. Microfilms Order No. 70-13492

A theoretical, but realistically definitive, description of the behavior of combustible mixtures in stagnation flow is presented. Numerical examples illustrating the results of the investigation are carried out for the specific case of fuel-lean mixtures of carbon monoxide and air. After formulation of the mathematical equations which govern such a reaction system, an efficient computational procedure which makes use of the technique of quasilinearization is developed for the solution of the steady state problem. For states exhibiting nearly complete conversion of fuel, the initial approximations necessary for this method of solution are found to be conveniently available from a more readily solved model involving the assumption of an infinitesimally thin flame. Dissert. Abstr.

N71-28923 Ohio State Univ., Columbus.

AN INVESTIGATION OF THE SHOCK IGNITION CHARACTERISTICS OF STATIC AND FLOWING COMBUSTIBLE MIXTURES

Darrell Winterton Walker (Ph.D. Thesis) 1969 166 p

Avail: Univ. Microfilms Order No. 70-14114

Research was conducted to study the ignition properties of flowing combustible mixtures; the objective being to determine the ignition temperatures, the ignition delay times of various combustible mixtures and to investigate the effect of the gas flow on the ignition process. Shock ignition temperatures of methane-air and ethylene-air mixtures were found to be relatively independent of the shock or flow conditions. For hydrogen-air mixtures, however, ignition was found to occur behind incident shock waves at considerably lower temperatures than behind reflected shock waves or than predicted by thermal explosion theory. The apparently low ignition temperatures were found to depend on the flow conditions, the mixture ratio, and the shocked static pressure. Dissert. Abstr.

N71-28924 Wisconsin Univ., Madison.

A NUMERICAL STUDY OF THE INITIATION OF CYLINDRICALLY SYMMETRIC GAS PHASE DETONATION

Bruce Alan Fesy (Ph.D. Thesis) 1969 142 p

Avail: Univ. Microfilms Order No. 70-3524

The development or initiation of a detonation wave, the stability of the wave, and the structure of the wave are discussed. Theoretical aspects of the initiation of cylindrical detonations, and a model for describing this initiation is proposed and tested. The model accounts for the effect of the ignition energy and the coupling of the reaction kinetics with the shock front. In the model, the effects of combustion are represented by an induction zone followed by heat release in the form of an inverse exponential function. Dissert. Abstr.

N71-28987 National Lending Library for Science and Technology, Boston Spa (England).

AN INVESTIGATION OF THE UNCERTAINTY IN THE THERMAL CONDUCTIVITY OF OXIDE FUELS, DEPENDING ON THE POROSITY

E.-M. Mueller 10 Dec. 1970 7 p refs Transl. into ENGLISH from Atomwirtschaft (Duesseldorf), v. 15, no. 9/10, Sep./Oct. 1970 p 434–435 In ENGLISH and GERMAN

(NLL-Windscale-Trans-448-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The thermal conductivity of oxide fuels was studied as a function of the porosity of the fuel. Numerical approximations were found by evaluating experimental data of known stoichiometry and pore distribution. F.O.S.

N71-29036 National Lending Library for Science and Technology, Boston Spa (England).

HEAT TRANSFER BETWEEN GAS AND SOLIDS IN SUSPENSION [O TEPLOOBMENE V GAZOVZVESI]

G. N. Khudyakov Nov. 1970 18 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Otd. Tekh. Nauk (Moscow), v. 2, 1953 p 265–277

(NLL-RTS-6129) Avail: Natl. Lending Library, Boston Spa, Engl.: 32s; 5 NLL photocopy coupons

Heat transfer between a gas and a solid was studied by introducing solid particles into a gas stream where the gas was cooled and the particles heated. The heat exchanger is described, and the experimental results are graphed. It is concluded that the heat transfer rate between gases and suspended solids can be reliably calculated, and the thermal unsteady state does not affect the rate of heat transfer between air and suspended quartz particles.

F.O.S.

N71-29043 National Lending Library for Science and Technology, Boston Spa (England).

THE INFLUENCE OF GAPS IN THE TRANSVERSE BARRIERS OF A JACKET TUBE HEAT EXCHANGER ON THE HEAT TRANSFER COEFFICIENT AND HYDRAULIC RESISTANCE [O VLIYANII ZAZOROV V POPERECHNYKH PEREGORODKAKH KOZHUKHOTRUBNOGO TEPLOOGMENNIKA NA KOEFFITSIENT TEPLOPEREDACHI I GIDRAVLICHESKOE SOPROTIVLENIE]

I. I. Chernobylskii et al Oct. 1970 12 p Transl. into ENGLISH from Izv. Kievsk. Politekhn. Inst. (Kiev), v. 30, 1960 p 134–142

(NLL-RTS-5990) Avail: Natl. Lending Library, Boston Spa, Engl.: 20s; 3 NLL photocopy coupons

Heat emission, heat transfer coefficients and hydraulic resistance were studied in the intertube space of a heat exchanger under various operating conditions. The tests were made at constant water and oil inlet temperatures using a heat exchanger designed to cool transformer oil by water. Graphs of the experimental results

are presented. It is concluded that the presence of a gap reduces the heat transfer rate, and when the gap is increased the reduction in hydraulic resistance in the intertube space is considerably greater than the reduction in the heat transfer coefficient. F.O.S.

N71-28048* Westinghouse Electric Corp., Pittsburgh, Pa.
SELF-ADJUSTING MULTISEGMENT, DEPLOYABLE, NATURAL CIRCULATION RADIATOR Patent
Arnold H. Redding, Robert A. Markley, and Walter D. Pouchot, inventors (to NASA) Issued 17 Oct. 1967 4 p Filed 16 Jun. 1966 Cl. 165-86 Sponsored by NASA
(NASA-Case-XHQ-03637; US-Patent-3,347,309; US-Patent-Appl-SN-559055) Avail: US Patent Office CSCL 20M

Radiators for use with the nuclear power plants which furnish electrical energy to lunar space stations are described. The high cost of labor, plus the difficulties in supplying replacement parts to the moon, make it imperative that a lunar waste heat radiator must be as maintenance-free as possible. Present estimates are that such a radiator must be able to radiate waste heat for 10,000 maintenance-free hours from a nuclear power plant capable of producing 100 kwe. Another problem arises as the result of the nuclear power plant for the lunar base being designed to contain two redundant power sources. One conventional radiator for each source would be undesirable in view of the weight and space limitation on the payload. It is, therefore, an object of this invention to provide a radiator which has far greater reliability and far less weight than presently known radiators, and yet still have equivalent heat rejection capabilities.
Official Gazette of the U.S. Patent Office

N71-28061* Chrysler Corp., Detroit, Mich.
CONSTANT TEMPERATURE HEAT SINK FOR CALORIMETERS Patent
Myron C. Ziemke and Rex S. Zerger, inventors (to NASA) Issued 12 Mar. 1968 4 p Filed 28 Jan. 1965 Cl. 73-190 Sponsored by NASA
(NASA-Case-XMF-04208; US-Patent-3,372,588; US-Patent-Appl-SN-428887) Avail: US Patent Office CSCL 20M

A calorimeter having a heat sink with a cavity filled with a material, such as Glauber-s salts, that absorbs heat by transformation so as to maintain the temperature of the heat sink substantially constant is discussed. The heat sink, primary or secondary, is integrated with a material that absorbs heat at a constant temperature. Such a substance can be chosen so that the transition temperature is slightly above the normal expected initial operating temperature of the calorimeter. When the calorimeter begins to absorb heat, the heat sink material will heat up a few degrees to reach the transition temperature and then melt, or decompose, absorbing heat at a constant temperature until all the material is transformed. Official Gazette of the U.S. Patent Office

N71-28062* Collins Radio Corp., Dallas, Tex.
HEAT CONDUCTIVE RESILIENTLY COMPRESSIBLE STRUCTURE FOR SPACE ELECTRONICS PACKAGE MODULES Patent
Harry M. Passman and Frederick W. Johnson, inventor (to NASA) Issued 19 Oct. 1965 4 p Filed 5 Oct. 1962 Cl. 165-47 Sponsored by NASA
(NASA-Case-MSC-12389; US-Patent-3,212,564; US-Patent-Appl-SN-229286) Avail: US Patent Office CSCL 20M

A method for cooling and mounting rack mounted electronic packaged modules is described. The space between the electronic module to be cooled and the mounting rack is bridged with heat conductive materials and cooling fluid is circulated through the racks. In this manner the insulating effects of air gaps, especially at low ambient pressures, are overcome. The materials used for the heat bridge and methods of installation are described. P.N.F.

N71-28063* North American Aviation, Inc., El Segundo, Calif.
METHOD AND DEVICE FOR COOLING Patent
Charles P. Morse, inventor (to NASA) Issued 17 Jan. 1967 6 p Filed 5 Aug. 1963 Cl. 60-267 Continuation-in-part of US Patent Appl. SN-864, filed 6 Jan. 1960 Sponsored by NASA
(NASA-Case-HQN-00938; US-Patent-3,298,175; US-Patent-Appl-SN-300957) Avail: US Patent Office CSCL 20M

The cooling of high temperature wall members and more particularly to a rocket type nozzle employing a method and system which effectively sprays a highly efficient cooling medium against a heated wall so as to produce superior cooling effects is described. By maintaining a cooling medium such as lithium, which has a latent heat of vaporization of approximately 8500 B.t.u./lb at a predetermined temperature and pressure and subsequently spraying a heated wall of a rocket nozzle with the coolant, superior cooling effects are realized. The pressure at which the cooling medium is maintained during the spraying thereof is of importance in determining the temperature at which the coolant will vaporize.
Official Gazette of the U.S. Patent Office

N71-28069# Pittsburgh Univ., Pa. Dept. of Mechanical Engineering.
CRITICAL HEAT FLUX IN AN ANNULAR TEST SECTION WITH AND WITHOUT VAPOR INJECTION
R. A. Dean, R. S. Dougall, and L. S. Tong Jul. 1970 116 p refs
(Grant NSF GK-1868)
(RR-5) Avail: Issuing Activity

The physical phenomenon which causes the boiling crisis was experimentally investigated. For the first time tests were conducted to study the similarity between boiling and the injection of saturated vapor. Earlier heat transfer and fluid flow studies, investigating various relationships between boiling and gas injection, were conducted with the injection of noncondensable gases rather than a saturated, condensable vapor. In this study the relative amount of heat addition and vapor injection was varied. This enabled the determination of the equivalence between boiling and injection in obtaining critical conditions. With this evidence, the effect of the momentum of the vapor injection on the stability of the main flow was used to verify a hypothesized critical heat flux model. This model is based on the injected vapor reaching a critical mass velocity at which it creates a hydrodynamic instability of the liquid vapor system. Author

N71-28075# Bettis Atomic Power Lab., Pittsburgh, Pa.
HEAT TRANSFER AND FLUID FLOW WITH APPLICATIONS TO PRESSURIZED WATER REACTORS. VOLUME 1: CHAPTER 1: INTRODUCTION. CHAPTER 2: HEAT CONDUCTION IN SOLIDS
Paul L. Pfennigwerth and W. S. (Bill) Minkler Jan. 1971 209 p refs
(Contract AT(11-1)-GEN-14)
(WAPD-TM-1000-Vol-1-Ch-1-Ch-2) Avail: NTIS

Concepts and laws of nuclear reactor heat transfer and fluid flow are developed and applied with emphasis on their essential unity and drama. Vectors and other mathematical tools are used extensively, but are developed as needed, with focus always on what's happening physically. Topics covered are: basic mathematical and physical concepts; heat conduction in solids; fluid dynamics; heat transfer in fluids; two-phase heat transfer and fluid flow; heat transfer by radiation. Author (NSA)

N71-28161* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TEMPERATURE REDUCING COATING FOR METALS SUBJECT TO FLAME EXPOSURE Patent
Sidney L. Simon and Norman H. Katz, inventors (to NASA) Issued 23 Feb. 1960 2 p Filed 30 Mar. 1956 Cl. 204-37
(NASA-Case-XLF-00035; US-Patent-2,926,123; US-Patent-Appl-SN-576291) Avail: US Patent Office CSCL 20M

A process of making a temperature reducing coating for high temperature metal alloys containing at least 3 percent iron

is described that is applicable to turbine blade surfaces exposed to flames. The metal alloy is dipped as an anode into an aqueous solution of phosphoric acid having a pH of about 2.2, subjecting it to a current flow at a density of about milliamperes per square inch for about 10 minutes, and then removing it from the bath and drying it at a temperature of more than 1200 C. G.G.

N71-29152* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LIQUID SPRAY COOLING METHOD Patent
John C. Freche, inventor (to NASA) Issued 18 Oct. 1960 4 p Filed 19 Aug. 1955 Cl. 253-39.1
(NASA-Case-XLE-00027; US-Patent-2,956,772; US-Patent-Appl-SN-529594) Avail: US Patent Office CSCL 20M

An apparatus for the cooling of gas turbine blades by liquid sprays is described. The apparatus uses free flowing spray tubes applied at spaced points around the stator diaphragm of the turbine with provision for varied mass flow from separate tubes to insure radial spread of coolant.
Official Gazette of the U.S. Patent Office

34 GENERAL

Includes information of a broad nature related in industrial applications and technology, and to basic research; defense aspects; information retrieval; management; law and related legal matters; and legislative hearings and documents.

N71-28138# Joint Publications Research Service, Washington, D.C.
TRANSLATIONS ON EASTERN EUROPE, NO. 176. DATA ON USES OF Ko-B1 CODING THEODOLITE
K. Hollai 7 Jun. 1971 23 p Transl. into ENGLISH from the report 'Der Kodentheodolit Type Ko-B1 und Einige Seiner Verwendungen' p 1–10
(JPRS-53299) Avail: NTIS

A theodolite which records during 0.02 sec the horizontal and vertical angles of a sighted object along with an 8-digit identifying number is described. The data are recorded on punched tape ready for computer processing. Specifications and operation of the 12.5 kg theodolite unit and the 13.5 kg electronic unit are given. Ion implantation in telecommunication unit production, pollution studies of the Baltic Sea, and recent developments in nuclear physics research are also discussed. N.E.N.

N71-28193*# National Aeronautics and Space Administration, Washington, D.C.
INDEX TO NASA TECH BRIEFS
Feb. 1971 295 p refs
(NASA-SP-5021(11)) Avail: NTIS CSCL 13H

An index to NASA 1970 Tech Brief is presented. Categories covered include: Electronics/Electrical; Electronic/Electrical systems; Physical Sciences; Materials/Chemistry; Life Sciences; Mechanics; Machinery, Equipment, and Tools; Fabrication Technology; and Computer programs. E.H.W.

N71-28201# Naval Research Lab., Washington, D.C.
REPORT OF NRL PROGRESS, APRIL 1971
Apr. 1971 45 p refs
Avail: NTIS

Research reported includes the following: (1) An oceanic thunderstorm study was conducted in which a data base of over 7-million synoptic observations by ships throughout the world ocean were analyzed to determine the universal time variations of ocean areas affected by the thunderstorms. (2) Three dislocation etchants and two chemical polishes were investigated as to their effective temperature and orientation ranges on sapphire, and a comparison was made of the etchants for effectiveness of dislocation pitting. (3) Technical progress on individual projects or problems of the research and development program are briefly summarized. The areas of research include acoustics, chemistry, communications sciences, mathematics, metallurgy, ocean sciences, and ocean technology. D.L.G.

N71-28267# Joint Publications Research Service, Washington, D.C.
THIRTEENTH SESSION OF THE INTERNATIONAL SPACE RESEARCH COMMITTEE
Yu. G. Grigoryev *In its* Space Biol. and Med., Vol. 5, No. 1 1971 17 Jun. 1971 p 128–136 refs (See N71-28248 18-04)
Avail: NTIS

A number of reports were presented on the following subjects: microbiological ecology of manned space flights, biological research in space, exobiology and the origin of life, sterilization and quarantine. Emphasis was placed on reports devoted to immunity and microbiological flora during prolonged manned flight. Author

N71-28272*# George Washington Univ., Washington, D.C. Government Contracts Program.
ANALYSIS OF PROFIT ON INVESTMENT Final Report
John Cibinic 12 Feb. 1971 44 p refs
(Contract NASw-1826)
(NASA-CR-119004) Avail: NTIS CSCL 05C

Profit analysis techniques, including a method of performing return on investment analysis, were developed as a means of training personnel in profit and fee negotiation. Results from the analysis indicate measurement of investment is feasible and negotiators are able to perform investment analysis under operating conditions. Determination of profit through the analysis does not appear to present major problems in overall effect on research and development and hardware contracts. However, with service contracts, it was evident that determination of profit through return on investment is not feasible without major policy changes. E.H.W.

N71-28305 National Lending Library for Science and Technology, Boston Spa (England).
RESEARCH POLICY IN ITALY IN THE SEVENTIES
A. Albonetti 30 Jul. 1970 20 p refs Transl. into ENGLISH of CNEN report RT/EC(69)2
(NLL-Risley-Trans-1966-(9091.9F); RT/EC(69)2) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

Problems of scientific and technological research and the part the research has played and can play in Italy's economic development are discussed. The technological gap between the United States and Europe is considered, and ways of narrowing the productivity gap are mentioned. It is recommended that Italian research activities be oriented to the needs of specific sectors in which the gap is evident (particularly space, aeronautics, computers, electronics, and nuclear power) and that the policy on patents and licences favor the research. A research policy is needed which is directed at the definition of priority scientific and technical objectives on a national level, coordination of research, integration with production activities, and dissemination of technological knowledge. Problems include organizing research center on reorganization of university research, and greater State engagement and industrial effort. The importance of collaboration with other European countries is also discussed. N.E.N.

N71-28540*# National Aeronautics and Space Administration, Washington, D.C.
GOVERNMENT, INDUSTRY, AND UNIVERSITY COOPERATION FOR ADVANCED RESEARCH AND TECHNOLOGY

F. B. Smith *In its* Biotechnology 1971 p 185–192 (See N71-28526 16-05)
Avail: SOD $2.75; NTIS CSCL 05A

A three way university-industry-Government cooperation in space research and technology is advocated. Some space industry accomplishments in aerospace technical developments are briefly described and their adaptations to nonspace needs are outlined. G.G.

N71-28941*# Cornell Univ., Ithaca, N.Y. Coll. of Engineering.
CONTROL ELEMENTS FOR AN UNMANNED MARTIAN ROVING VEHICLE Annual Progress Report, 1 Jul. 1969–30 Jun. 1970
R. L. Wehe and R. E. Osborne 1 Jun. 1971 43 p refs Revised
(Contract NSR-33-010-055)
(NASA-CR-119030) Avail: NTIS CSCL 13F

Design development of equipment previously designed and built to perform specified tasks aboard an unmanned roving vehicle was undertaken. These tasks are: obstacle sensing by both a laser sensor and a tactile sensor; obtaining a soil sample and determining the mechanical properties of undisturbed soil; vehicle navigation to enable the vehicle to proceed to a designated destination; and communication links to enable the vehicle to receive commands and transmit data to the controller. The specific objectives accomplished during the period are summarized. Author

N71-29064# Bureau of Mines, Salt Lake City, Utah. Metallurgy Research Center.
PRELIMINARY SEPARATION OF METALS AND NONMETALS FROM URBAN REFUSE Solid Waste Research Program
K. C. Dean, C. J. Chindgren and Le Roy Peterson Jun. 1971 12 p refs
(BM-TPR-34) Avail: Issuing Activity

Horizontal and vertical air classification systems were tested individually and in simulated tandem use for the recovery of ferrous and nonferrous metals and of other noncombustible and combustible products from shredded urban refuse. The horizontal air system with a larger tonnage throughput was used to obtain preliminary separations, and a smaller capacity vertical system was used as a cleaning device. Air elutriation, magnetic separation, and screening of shredded minus 6-inch municipal refuse recovered 92 percent of the metal in a relatively clean iron product contaminated only by adhering coatings or entrapped materials, recovered 97 percent of the combustibles in a 97-percent combustible product, and rejected 88 percent of the nonmetal noncombustibles. Cleaning of the preliminary combustible fraction produced a 98-percent paper product while rejecting other combustibles (plastics, rubber, textiles, etc.) into a 94-percent combustible product. Retreatment of the preliminary noncombustible fraction produced a relatively clean glass product. Author

N71-29068# Air Force Cambridge Research Labs., Bedford, Mass.
REPORT ON RESEARCH AT AFCRL, JULY 1967–JUNE 1970
La Verne Woods Dec. 1970 487 p
(AD-720277; AFCRL-71-0022; AFCRL-SR-115) Avail: NTIS CSCL 3/2

This is the fifth in a series of reports on research at the Air Force Cambridge Research Laboratoies. The report covers a three-year interval. The work of each of the eleven laboratories is discussed separately in chapters with an overall introductory chapter on AFCRL management and logistic activities during the reporting period. Author (GRA)

N71-29062# Committee on Aeronautical and Space Sciences (U.S. Senate).
NASA AUTHORIZATION FOR FISCAL YEAR 1972
Clinton P. Anderson Washington GPO 1971 109 p Report on H.R. 7109 by Comm. on Aeronaut. and Space Sci., 92d Congr., 1st Sess., 8 Jun. 1971 *Its* Calendar No. 142
(Rept-92-146) Avail: US Capitol, Senate Document Room

The Senate committee recommendations on the NASA appropriations for FY 1972 are reported. The budget requests and appropriations in the areas of research and program planning, research and development, and construction of facilities are shown. F.O.S.

N71-29066# Joint Publications Research Service, Washington, D.C.
SCIENTIFIC AND TECHNICAL PROGRESS RATE: INDEX OF EFFICIENCY OF CONTROL OF THE ECONOMY
V. A. Trapeznikov 2 Jun. 1971 47 p refs Transl. into ENGLISH from Avtomat. i Telemekh. (Moscow), no. 4, 1971 p 5–36
(JPRS-53271) Avail: NTIS

The economic role of scientific and technical progress in controlling the national economy is demonstrated, and the economic effectiveness of science is evaluated. The standard of living increase is presented as a function of scientific and technical progress. A foundation is laid for the information nature of labor and the difference in stored information and consumed information in the control process. Author

N71-29067# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
[GENERAL PHYSICS, PLASMA DYNAMICS, AND COMMUNICATION SCIENCES AND ENGINEERING] Quarterly Progress Report
H. J. Zimmerman, G. G. Harvey, and S. J. Mason 15 Jan. 1971 322 p refs
(Contract DA-28-043-AMC-02536(E))
(AD-720234; QPR-100) Avail: NTIS CSCL 9/4

Contents: General physics; Plasma dynamics; and Communication sciences and engineering. GRA

N71-29082*# ABT Associates, Inc., Cambridge, Mass.
URBAN DEVELOPMENT APPLICATIONS PROJECT Quarterly Report, 1 Oct.–31 Dec. 1970
31 Dec. 1970 139 p refs
(Contract NASw-2022)
(NASA-CR-119025; QR-4) Avail: NTIS CSCL 05K

Plans were formulated for the further development of a contamination detector, intumescent paints and fire retardant foams, and an ultrasonic torque wrench; we also began to see what promises to be one of the most significant barriers to the process of technology transfer which we have yet encountered, and the acquisition of development funds for these technologies. Specific investigations were made in the areas of fire retardant coatings and smoke detection systems to compare NASA technology to the state-of-the-art in the building industry. Author

N71-29116 National Lending Library for Science and Technology, Boston Spa (England).
THE PRINCIPLE CHANNELS FOR TRANSMITTING SCIENTIFIC AND TECHNICAL INFORMATION AND THEIR EFFECTIVENESS BASED ON SURVEY RESULTS
O. E. Buryi-Shmaryan 12 Mar. 1971 14 p refs Transl. into ENGLISH from Nauchn.-Tekhn. Inform. Byul. Leningr. Politekhni. Inst., Ser. 1 (Leningrad), no. 2, 1970 p 5–9
(NLL-Risley-Trans-2116-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.; 1 NLL photocopy coupon

Principle channels for transmitting scientific and technical information and their relative effectiveness are discussed, and the results of a survey are presented. Analysis of the operating experiences of information services in a number of businesses, as well as a review of the literature, resulted in identification of four

main groups of channels: (1) documentary information obtained from the reference service or information stock of the business or directly by the information receiver; (2) information obtained by the receiver from his participation in scientific and technical meetings of all types; (3) information received during visits to study advanced scientific, technical, and production systems; and (4) information from personal contacts between specialists during the course of their work. Tabulated data from a survey of one business firm are presented in which the effectiveness of each of the four types of channels as an information transmitter was assessed. Relative expenditures for each of the main channels, with respect to one information receiver, are also indicated. A.C.R.

N71-29146# Committee on Armed Services (U. S. House).
REVIEW OF DEPARTMENT OF DEFENSE WORLDWIDE COMMUNICATIONS, PHASE 1 From Armed Services Investigating Subcommittee
Robert H. Mollohan Washington GPO 1971 46 p Presented by the Comm. on Armed Serv. at 92d Congr., 1st Sess., 10 May 1971
Avail: US Capitol, House Document Room

The committee investigation of the DOD worldwide communications is reported. The communications concerning the U.S.S. Liberty, June 7 to 8, 1967, U.S.S. Pueblo, January 23, 1968, and EC 121, April 24, 1969 are reviewed. Conclusions and recommendations are included. F.O.S.

N71-29148# Joint Publications Research Service, Washington, D.C.
SPACE RESEARCH AND SCIENTIFIC-TECHNICAL PROGRESS
Boris Nikolayevich Petrov 3 Jun. 1971 46 p ref Transl. into ENGLISH from the book 'Kosmicheskiye Issledovaniya i Nauchno-Tekhnicheskiy Progress' Moscow, 1971 p 2–48 (JPRS-53280) Avail: NTIS

A discussion is presented on space research, the conquest of outer space, and the spacecraft and instruments permitting the exploration. Manned and unmanned space flights, earth resource studies, space-based radio astronomy, biomedical experiments, lunar and planetary investigations, space communication, space-borne meteorological observations, aerospace technologies, and international cooperation are considered. N.E.N.

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This final report, prepared at the Manned Spacecraft Center by the Apollo 11 Mission Evaluation Team, is the technical record of one of mankind's greatest achievements: the first Moon landing. The Apollo 11 mission was the 11th in a series of flights using Apollo flight hardware and was the 1st lunar landing mission of the Apollo Program. It was also the 5th manned flight of the command and service modules and the 3rd manned flight of the lunar module. Because of the excellent performance of the entire spacecraft, only the systems performance that significantly differed from that of previous missions is reported. A history of the Apollo flights is given in one of the appendixes. *Paperbound.* 232 pp. For sale by the National Technical Information Service, Springfield, Va. 22151, for $3.00.

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By FLOYD WILLIAM STECKER

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